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INTERNATIONAL COMPETITION IN SERVICES

BANKING
BUILDING
SOFTWARE
KNOW-HOW . . .

CONGRESS OF THE UNITED STATES
OFFICE OF TECHNOLOGY ASSESSMENT

J 952-43

Recommended Citation:

U.S. Congress, Office of Technology Assessment, *International Competition in Services*, OTA-ITE-328 (Washington, DC: U.S. Government Printing Office, July 1987).

Library of Congress Catalog Card Number 87-619820

For sale by the Superintendent of Documents
U.S. Government Printing Office, Washington, DC 20402-9325
(order form on p. 403)

Foreword

As the nearly 100 member nations of the General Agreement on Tariffs and Trade (GATT) head into the Uruguay Round trade negotiations, the United States—chief advocate of an open international economy—finds many of its manufacturing industries less than competitive in that international economy. The Nation's trade deficit remains at unprecedented levels, our international debts exceed our credits, and living standards are headed downward. Few signs point toward a return to the comfortable position the United States enjoyed with respect to its trading partners and competitors 10 or 15 years ago.

Most simply, the U.S. dilemma can be put as follows. The international competitiveness of American firms in most manufacturing industries has been in decline, in large part because of growing competence in other parts of the world. As this assessment shows, the United States remains highly competitive in many service industries. But trade in services will remain small compared to trade in goods, and many of the benefits from foreign investments by American service firms accrue to the host nations where U.S.-based banks, insurance companies, accounting firms, and other suppliers of services do business. Services cannot right the Nation's trade balance, even granting the many ways in which a strongly competitive service sector benefits the competitiveness of American manufacturing firms.

As the U.S. negotiating strategy in the Uruguay Round emerges, the Nation's policymakers will have to balance the needs of service industries and manufacturing industries. These coincide some of the time, but not always. They will also need to decide in what ways and how strongly to press for measures that would strengthen GATT and further open the world trading system. Most importantly, Congress and the executive branch will have to continue seeking *domestic* policies that can help U.S. firms compete effectively, prepare Americans to work in the knowledge-based industries that will remain a major U.S. strength, and develop an approach to policies for economic adjustment suited to U.S. traditions and the Nation's political system. Past OTA assessments—as well as this one—show that the situation of U.S. industries has changed fundamentally over the last 15 years. The policymaking system has not caught up.

This assessment was requested by the Senate Committees on Governmental Affairs and Foreign Relations, and the House Committee on Small Business. OTA is grateful for the assistance provided by many individuals, inside and outside the Federal Government during the course of this assessment and in particular the cooperation of the Office of the United States Trade Representative and the Departments of Commerce, State, and Treasury. Full responsibility for the contents rests with OTA.

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Chapter 1

Summary

Domestically as well as internationally, services and manufacturing depend on one another. Given the size and diversity of the U.S. economy, any view of the future that sees the services taking the place of manufacturing has pushed the distinctions between them too far. As this assessment shows, there is no choice to be made between a manufacturing economy and a service economy. The choices concern the pace of change and the kinds of skills that Americans will need to work productively in emerging industries. They also concern Federal policies to aid and assist the adjustments involved, and an international trade regime that will permit the synergies between domestic and foreign production, goods and services, American know-how and foreign know-how, to multiply. Among the most critical policy choices will be those affecting Americans who lack the skills for full participation in the kind of economy that will emerge over the next 30 years.

The international infrastructure for services has become critical for the long-term competitiveness of U.S. firms in *many* industries. More than 70 percent of all Americans work in the service sector of the economy (table 32, ch. 7). In nations otherwise as different as the United States, Japan and the United Kingdom, more people find jobs in service industries than in manufacturing, and services account for more than half of gross domestic product. Many governments have instituted policies, often including trade protection, to encourage growth in the intermediate or business services that form a primary subject of this assessment.

Still, while the services make a significant contribution to the U.S. balance of payments, direct trade in manufacturing remains much larger. The share of services in *total* world trade has remained more-or-less constant at 17 to 18 percent over the past 15 years. Thus the dominance of services domestically—in terms of employment and share of gross output—does not carry over to the international trade arena. Even so, beginning in 1982, the U.S. Government made reductions of trade barriers in services the centerpiece of its proposals for a new round of multilateral trade negotiations (box A). These proposals were opposed in parts of the developing world. As preparations continued, the emphasis on services receded only slightly; the Uruguay Round, initiated in September 1986, gives them a prominent place. Why did the United States raise the negotiating stakes so high? Why did other nations react as they have? Does it make sense to press for international agreements on services at a time of deteriorating trade relations generally? As this report will show, the answers to such questions depend as much on the interrelationships of the services and manufacturing as on the magnitude of service exports themselves.

This assessment, requested by the Senate Committees on Governmental Affairs and Foreign Relations, and by the House Committee on Small Business, looks with particular care at four services:

- banking (ch. 3);
- engineering and construction (E&C, ch. 4);
- information technology (IT) services, including most services related to data processing and communications, but not equipment (ch. 5); and
- technical licensing (a source of revenues for manufacturing firms almost exclusively, ch. 6).

Beyond specific expressions of interest by the requesting Committees, the reasons for choosing these four sectors included dependence on technology and its significance for international competition, and dollar value of transactions as recorded in the U.S. balance of payments. All four have strategic importance, in part because they are intermediate services provided mostly to other businesses. This means that competitive strength can create a powerful if indirect stimulus for other parts of the U.S. economy—as when multinational manufacturing companies make use of international com-

Box A.—Services in the New Trade Round

In September 1986, trade officials from most of the 90-plus members of the General Agreement on Tariffs and Trade (GATT, the principal organization within which governments negotiate the rules for world trade) agreed on plans for a new round of multilateral trade negotiations (MTN)—to be known as the Uruguay Round. Since 1982, the United States had been pressing for an MTN round that would address barriers to services trade (ch. 9). Other "new issues" rose in prominence as preliminary discussions continued. Despite ongoing opposition from a group of developing nations, led by Brazil and India, most of the new issues raised by the United States will be part of the Uruguay Round negotiations, although not necessarily as prominent as the United States might have wished. In addition to services, these include restrictions on foreign direct investment that may distort trade flows (most simply, performance requirements that make exporting a condition for inward investment) and protection for intellectual property (strengthening of patents and copyrights, stiffer enforcement of laws prohibiting counterfeiting of goods).

To begin the process of liberalizing trade in services, the United States has sought the following:

- Agreement that "national treatment" should, in general, govern services trade. For most of the services, this principle—that foreign firms should be treated the same as domestic (national) firms—implies the right of establishment.
- "Transparency" in regulations and barriers that affect services trade—i.e., explicit rather than hidden rules.
- GATT procedures for resolving disputes concerning trade in services.

Given a satisfactory umbrella agreement incorporating such provisions, GATT parties might (or might not) move on to negotiations dealing with particular service industries during the Uruguay Round.

While the United States got most of what it wanted in the 1986 Ministerial Statement, services negotiations will take place in parallel with, rather than as part of, negotiations on goods trade. This concession to the developing countries—which argue that services do not belong in GATT at all, but should be discussed in other international bodies—may make it more difficult to eventually integrate whatever agreements are reached into the structure of GATT codes and adjudication mechanisms. On the other hand, there are good reasons, as discussed later in this report, for pursuing negotiations on services in other multilateral forums as a supplement to the GATT talks, and also for bilateral discussions on services.

The Uruguay Round is scheduled to run through 1990, but it seems quite possible, given the complexity of the issues to be negotiated, that 4 years will not be enough to reach meaningful agreements; this set of trade talks could easily continue well into the 1990s. The process of bringing services trade under GATT discipline will be a difficult one, for two closely related reasons. First, many of the services in many countries have been heavily regulated for years (examples include banking and insurance). State ownership has also been common (air travel, telecommunications). Second, almost all the trade and investment restrictions are non-tariff in nature. Many governments design their regulatory and supervisory policies to exclude foreign firms or favor domestic firms. The preceding Tokyo Round took up non-tariff barriers affecting trade in goods; progress proved painfully slow. When it comes to many of the services, sensitivities will be even higher, if only because openness to trade implies rights of establishment and hence inward investment.

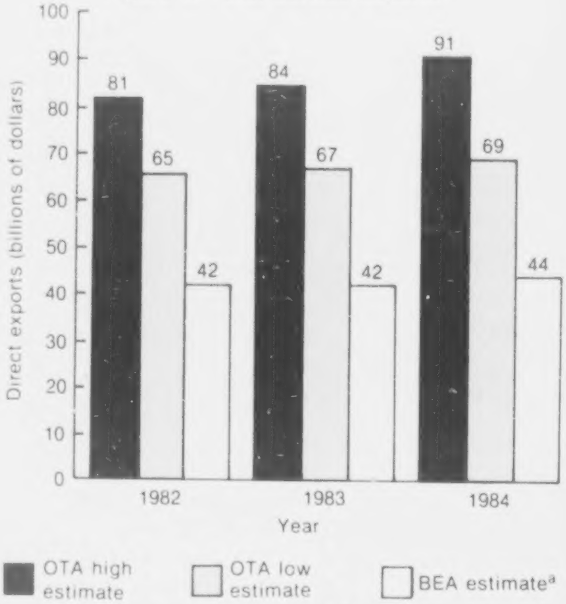
munications networks to manage global operations. Because this assessment deals with international competitiveness, most of the analysis centers on businesses. Sometimes the interests of U.S. companies correspond to the interests of other groups or the Nation as a whole, sometimes not. But it is business organizations that compete internationally—not governments, not people (as consumers, as workers), not entire economies.

PRINCIPAL FINDINGS

Services and the U.S. Economy

1. OTA's estimates show that services make a greater contribution to the U.S. balance of payments than the official figures imply—a surplus of perhaps $14 billion in 1984, rather than only $2.3 billion. Services account for about one-quarter of U.S. exports, substantially more than the 17 percent indicated by official government statistics (figure 1).[1] But while services help the U.S. trade position more than had been realized, OTA finds no reason to expect that exports of services will grow more rapidly than exports of goods; the ratio of service exports to total exports will probably not change very much over the next decade or two. *Trade in services will remain considerably smaller than trade in goods*; services may have a dominant place in domestic employment and production, but not in international trade (figure 2).

Figure 1.—U.S. Service Exports



[a]Bureau of Economic Analysis, Department of Commerce.

SOURCES: *Trade in Services: Exports and Foreign Revenues* (Washington, DC: Office of Technology Assessment, September 1986), p. 39; R.C. Krueger, "U.S. International Transactions, First Quarter 1986," *Survey of Current Business*, June 1986, pp. 36-70.

2. *Relatively few American jobs depend directly on trade in services.* Not only does domestic production of services greatly exceed exports and imports of services, but U.S.-based service firms do more overseas business through foreign affiliates than through direct exporting. Investment abroad means jobs in foreign countries. (And foreign investment in the United States means jobs here.) Almost certainly, services embodied in U.S. goods exports contribute more to U.S. employment than do exports of services.

The need to produce services at the point of consumption limits growth prospects for exports, in contrast to goods, which can be shipped and stored. Although advances in communications and transportation have made it easier and cheaper to supply services at a distance, the changes are incremental, with no real prospect of radical transformation. In general, when U.S.-based firms establish overseas affiliates in the services, these affiliates are staffed by local people and purchase in the local market.

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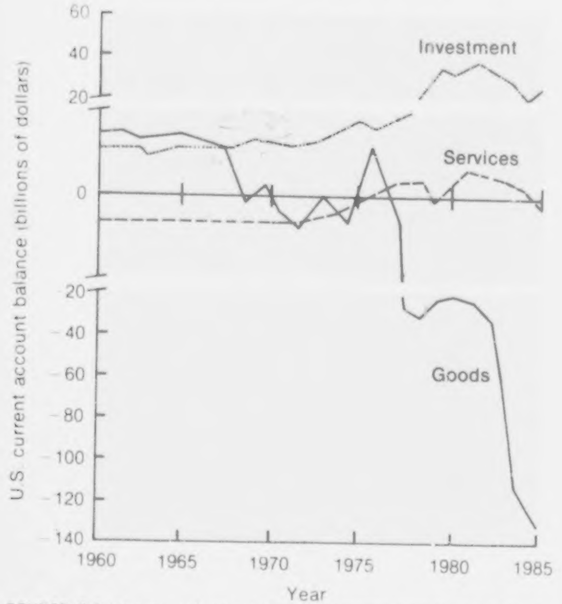
[1] The $14 billion figure corresponds to the middle of the range of OTA's estimates. For 1984, OTA places U.S. exports of services, excluding banking at $69 billion to $91 billion. Merchandise exports that year came to $220 billion. The ratio of the midrange figure for services to all exports equals 0.27. Based on the official Federal Government figure for 1984 service exports, $43.8 billion, services come to only 17 percent of all exports. See *Trade in Services: Exports and Foreign Revenues* (Washington, DC: Office of Technology Assessment, September 1986), p. 38.

Figure 2.—U.S. Trade Balance According to Official Government Figures



SOURCE: R.C. Krueger, "U.S. International Transactions, First Quarter 1986," *Survey of Current Business*, June 1986, pp. 42-43.

3. *While overseas investments may not contribute very directly to U.S. jobs, exports, or international competitiveness, the indirect and strategic benefits to the Nation's economy can be substantial.*

American multinationals—whether they produce services, goods, or both—stand to benefit from further opening of trade and investment opportunities in the services. These benefits will come in part from a better developed global infrastructure for supporting their business activities: deeper and more integrated capital markets; well-established and comfortable working relationships with the overseas affiliates of the accounting firms, advertising agencies, insurance companies, and law firms that they deal with at home; cheap and reliable communications networks. The synergies and strategic benefits flowing from such an infrastructure can aid U.S. economic growth and competitiveness, and create new domestic jobs, even though impacts within the United States may be hard to trace.

4. International competitiveness in high-value-added manufactured goods (e.g., computers or commercial aircraft) depends on knowledge-based services—computer software, engineering, banking and finance, business services of all kinds. *To maintain a society with high living standards and large numbers of well-paying jobs, the United States must remain competitive in both high-value-added goods and knowledge-based services*; this, in turn, requires a well-educated and highly skilled labor force, one that can adapt to changing competitive conditions.

5. Government policies, particularly regulatory policies, have greater impacts on many service industries than on goods-producing industries. Sometimes these policies help the international competitiveness of American firms, sometimes they hurt. But impacts on competitiveness seldom get much attention from policymakers. Given the increasing integration of the U.S. and world economies, *Federal agencies with regulatory or supervisory authority over the services will have to begin paying consistent attention to international competitiveness*. If they do not, the competitive ability of American service firms may begin to suffer. If U.S. service industries suffer the same kinds of competitive declines as U.S. manufacturing industries, the Nation's living standards will be in even greater danger.

The U.S. Competitive Position

1. Internationally, *the United States maintains a position of competitive advantage in most services*—although U.S. competitiveness varies a good deal among these industries. Some —e.g., engineering and construction—have been slipping. Others, notably the information-related services, remain highly competitive. (Industry-specific findings appear later in this chapter.)

Figure 3 compares the U.S. balance of payments in services, according to the official figures, with that in goods. The chart shows that the United States ran large deficits in goods

YJ
CF
D-ABYJ
Boeing 747

Photo credit: Lufthansa

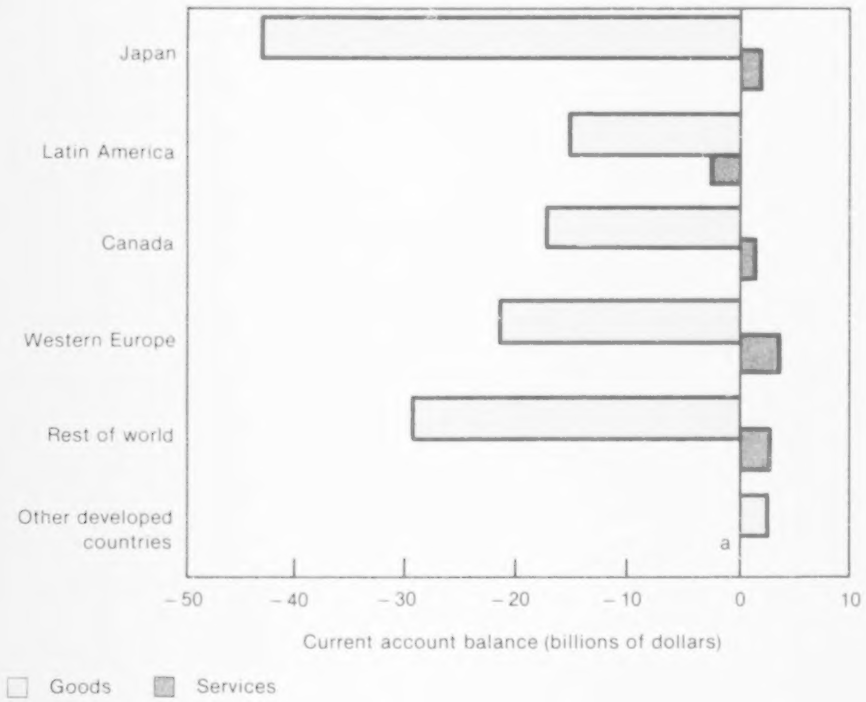
American jetliners, part of Lufthansa's fleet, at Frankfort airport

trade with almost all regions of the world in 1985, coupled with surpluses in services—albeit small—everywhere but Latin America (where tourist travel by Americans pushes the balance to the deficit side). The official figures underestimate U.S. exports and imports of services, but are the only source of comprehensive geographic detail; more accurate data would disclose somewhat larger surpluses with most regions.

2. The U.S. surplus on services trade has fallen—according to OTA's midrange estimates, from about $20 billion in 1982 to $14 billion in 1984. As for trade in goods, some of this decline reflects the strength of the dollar, but *in many of the service industries, as in manufacturing, continuing economic growth and development have helped other countries narrow the gap with the United States.* For example, E&C firms in both the newly industrializing and less developed countries (NICs and LDCs) have made substantial strides in their technological and managerial capability over the past 15 years.

3. As in so many manufacturing industries, *many of the future competitive threats in the services will come from Japanese firms.* Japan has already proven its competitive ability in

Figure 3.—U.S. Trade Balance by Region, 1985



[a] Services balance with "other developed countries" = $0.26 billion.

NOTE: The sum of the balances in the figure does not equal the 1985 current account deficit because the current account includes other items not in the chart (investment income, government transactions, and unilateral transfers).

SOURCE: R.C. Krueger, "International Transactions, First Quarter 1986," *Survey of Current Business*, June 1986, pp. 36-70.

computer hardware and in telecommunications equipment. Improvements in services ranging from software products to computer and communications networks will follow, if at first only to meet Japan's own needs and to take advantage of the country's expanding hardware base. This coming thrust into information-based services promises to boost Japan's international competitiveness still further in *manufacturing*.

Japanese E&C firms have long since demonstrated their competitive ability. The banks, as discussed below, have been following Japanese manufacturers into international markets, aided by the capital reserves accumulating as a result of huge trade surpluses; if Japanese banks succeed in taking competitive advantage of their asset base, they could quickly take on still more prominent roles in world financial markets.

Finally, Japan's policymaking system seems more attuned than those of Western governments to the needs and consequences of the shift toward an information-centered economy. To this point, policymakers and bureaucrats in Japan have tended to view competitiveness in services as flowing from competitiveness in manufacturing. But they also recognize that the Japanese economy faces an eventual transition from mass production of consumer durables to a structure centered on information technologies. Government officials in Japan are doing their best to lay the groundwork for a competitive set of industries in the future, as their economy emerges from this transition.

Negotiations on Trade in Services

1. The United States has made reductions in barriers to services trade a primary goal in the Uruguay Round trade talks. Although immediate payoffs in terms of U.S. jobs and U.S. exports will be small, *the long-run strategic importance of services makes the goal a vital one.* The negotiations promise to be lengthy and difficult: far more often than in manufacturing, trade (and investment) barriers in the services —almost always non-tariff in nature—have domestic policy rationales.

Governments regulate banking and insurance to protect consumers; many countries view telecommunications as having elements of natural monopoly. Such factors raise sensitivities several notches above those associated with non-tariff barriers (NTBs) affecting trade in goods. It is easy for governments to tilt the regulatory and supervisory policies that affect service industries to make life difficult for foreign firms. Past GATT negotiations aimed at reducing NTBs affecting goods have proved less successful than hoped. With a great deal of room for maneuver and for ambiguity, it will take patience and persistence to reach meaningful agreements on barriers to services trade, inside or outside of GATT.

2. No matter the perspective from which the service industries are viewed, differences seem to outweigh similarities, even among the knowledge-based intermediate services that form the primary subject of this assessment. Generalizations concerning the international competitiveness of U.S. service industries cannot be pushed too far. Government policies, here and overseas, affect them in different ways; measures that help one may hurt another. Liberalization would benefit some U.S. industries more than others. The lists of those helped and those harmed will differ among countries.

Any negotiating strategy for the service industries, in either a bilateral or a multilateral framework, must be based on a well-founded analytical grasp of the differences among them. Lacking such a grasp risks outcomes that, on balance, would do more harm than good to U.S. interests. Even given such an understanding—difficult to develop, if for no other reason than the gaps in the data from which analysis must begin—*a multilateral trade agreement embracing the services will almost certainly mean diminished competitive prospects for some U.S. service industries, along with brighter prospects for others.*

3. U.S. policymakers will be faced with decisions on which topics will be most appropriate for GATT and which for other venues (e.g., the Organization for Economic Cooperation and Development, bilateral negotiations, specialized organizations). Longstanding international arrangements exist for services including shipping, air travel, and telecommunications. Bodies like the World Intellectual Property Organization will continue to provide a forum for negotiations on intellectual property protection. Decisions on international technical standards could have considerable impact on trade and investment in the decades ahead. *Choosing the right mix of topics in the right mix of forums would be a major step toward a trade policy that is forward-looking rather than reactive.*

The process entails more than monitoring foreign government actions (and seeking to learn from foreign experience). The United States also needs to monitor and adjust its own policies. As chapters 9 and 10 make plain, the list of policy issues that affect trade and competition in the services is a long one. The issues range from very general—the ability of the Federal Government, as currently organized, to cope with economic interdependence, new patterns of international business, and continuing pressures for domestic adjustment—to quite specific, such as illegal copying of computer software.

4. Other governments, particularly in the developing world, have often viewed the U.S. push on services as forcing them into a battle they will probably lose. They will seek conces-

sions on trade in goods in return for liberalization in services.

Given a massive U.S. deficit in goods trade, which a falling dollar will help but not eliminate, policymakers and trade negotiators will have to balance priorities, not only among the services, but between services and goods. Trade agreements always lead to winners and losers, if for no other reason than that some nations and some industries benefit more than others; in a very real sense, services and goods compete with one another. *To get agreements that it wants in services, the United States will undoubtedly have to make concessions elsewhere.*

U.S. negotiators will need to seek advice and guidance from a wide range of potentially affected interests, particularly if the Uruguay Round negotiations go beyond an umbrella agreement to sector-specific issues. New advisory mechanisms may be needed to bring services-related negotiations to a satisfactory conclusion. Government agencies charged with conducting the negotiations, notably the Office of the U.S. Trade Representative (USTR), may well require added resources.

5. OTA finds no compelling reason, at this time, to give either bilateral or multilateral negotiations in particular service sectors unusually high priority. Of those services with clear strategic importance for leveraging U.S. exports and spurring economic growth, *telecommunications services and computer software come closest to meriting special consideration.*

In some contrast, international banking, alone among the services, seems to carry the potential for severe *disruptive* impacts, and hence for economic dislocations potentially comparable, say, to the oil shocks of the 1970s. Here, however, continuing steps aimed at preserving stability are likely to take place quite independent of GATT.

6. In part because more nations have been evading the intent and sometimes the letter of GATT codes, the ability of the system to manage trade in goods has deteriorated. The strains will probably continue to build. Countries with heavy debt burdens need to find foreign markets for their goods, but face new restrictions in many industrial nations, including the United States. At the same time, many of these developing countries see their relatively small service sectors as vulnerable to foreign competition and in need of protection. They may feel there is little to be gained from agreements on services trade, unless accompanied by an opening of markets for their goods.

With the United States and other industrialized nations, as well as the developing countries, more heavily dependent on trade in goods than services—and with the United States already having large shares of many service markets—aggressive pursuit of services agreements could harm prospects for improving the ability of the trading system to cope with strains over trade in goods. U.S. negotiating objectives may have to adapt to this reality as the Uruguay Round continues. Unless GATT as an institution can be substantially strengthened, its disciplinary force will continue to wane; *GATT could become irrelevant.*

Trade and Competition by Sector

Banking and Financial Services

International banking (ch. 3)—only loosely similar to the retail financial services familiar to most Americans—has been growing rapidly, fueled by deregulation and new products, many of them possible only because of developments in computer and telecommunications technologies. Examples range from 24-hour securities trading to the lightly regulated offshore markets for products like Eurobonds. With lending less profitable in recent years, banks have turned to new and largely unregulated products in part to earn fees for services. The offshore markets—in essence, operating outside the regulatory reach of national governments—have been expanding at literally explosive rates. Growth in securitization means that almost any financial instrument—e.g., commercial paper, bundles of mortgages—can now be traded. Larger corporations can market their own secu-

सेक्यूरिटी खरिद बिक्री केन्द्र लि.
कमलादी काठमाडौं
शेयरको बजार भाउ
कारोबार

Photo credit: Steven Weissman, NYT Pictures

Stock exchange in India

rities, manage their own short-term assets. When they do so, they are in effect competing with their banks. Taken together, these developments raise new questions concerning the safety and stability of the international banking system.

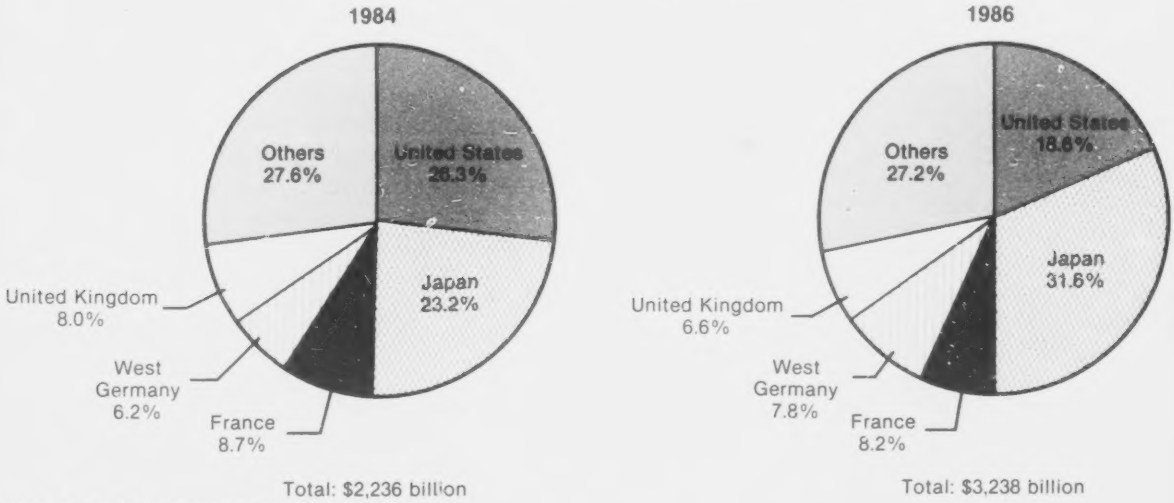
Deregulation means more competition, driving down profits. Banks seek new products and new international markets in part to maintain their profit margins. Deregulation becomes contagious. When one nation relaxes its supervisory authority, others must follow, else risk losing business. But deregulation cannot go too far without threatening the stability of the system.

In the United States, regulatory and supervisory authorities find that more of their decisions have international ramifications. Impacts on international competitiveness must be built into decisonmaking processes.

This is an industry, then, with intense competition among financial institutions in many countries, one where substantial advantages are hard to come by. American banks have done well, in part because of their accumulated experience in a relatively open market. Only Japanese banks, with their rapidly growing financial muscle—in large part a legacy of Japan's vast trade surplus in manufactured products—have mounted a real challenge (figure 4).

1. Internationally, a great deal of momentum drives the technology that leads to innovations

Figure 4.—International Assets of Major Banks by Country



NOTE: Figures are for September of each year.

SOURCE: A. Nicoll, "Japanese Bank Lending Surges Ahead," *Financial Times*, Jan. 20, 1987, p. 22. Original source, Bank for International Settlements.

in financial service products, to market growth, and to pressures for deregulation. *The changes taking place raise new concerns for the safety of the international banking system.* Electronic networks move huge sums of money around the world almost instantaneously. Where once regulatory authorities could expect to see warning signs days or weeks before a bank failed, now the process could be over before the authorities charged with safeguarding the system are able to react. Innovation in financial services will continue, in rather unpredictable directions. Regulatory and supervisory bodies will have to cope with dynamic, rapidly changing conditions, nationally and internationally, for the foreseeable future.

2. Despite the bad loans they have made internationally, *U.S. financial services firms, as a group, remain highly competitive.* Banks in other countries have their share of problem loans, while American firms have been leaders in new financial services and innovative applications of technology—many of the latter helping them escape the regulatory thrusts of national governments. As other countries deregulate, American banks will continue to take advantage of their learning and experience here to penetrate foreign markets. Nonetheless, some U.S. financial services firms will make mistakes and find themselves in competitive difficulty; some may fail or be purchased by more successful rivals.

3. Among national banking industries, *only the Japanese have mounted a real threat to the United States in financial services.* Japanese banks followed Japanese manufacturing firms onto the world stage. Japan now can claim most of the biggest banks in the world, as measured by assets. The speed with which Japanese financial institutions turn new opportunities into competitive reality—and the magnitude of the competitive threat to U.S. banks—depends first of all on the speed of deregulation in Japan's *domestic* financial markets. The faster Japan's Government liberalizes at home, the freer Japanese banks will be to compete overseas.

4. While U.S. financial services firms have been moving into overseas markets, foreign banks have moved into the United States. In both retail and commercial banking, *some foreign banks will be quite successful in the United States, but this in itself should not be taken as a sign of flagging U.S. competitiveness.* It is, rather, a natural consequence of an open and attractive market, with fewer regulatory restrictions than in the past. Foreign banks come here in part because of the size of U.S. markets, in part because their corporate clients have invested in the United States, in part because they seek experience in a deregulated and highly competitive environment.

5. To considerable extent, U.S. banking regulations have been overtaken by events. Many of the regulatory barriers—e.g., those separating commercial from investment banking—seem bound to crumble further. While regulations will continue to have significant effects on competitive outcomes internationally, most of these are secondary and indirect—hard to trace and hard to predict. This real but less than obvious influence is precisely the reason that *policymakers and regulators in the United States will have to take far greater account of the ramifications of their decisions for international competitiveness in banking.* Financial services is plainly an industry that, in its domestic as well as its international dimensions, will challenge the creativity of regulators as well as bankers.

Sometimes U.S. regulations give foreign banks advantages, and in other cases American banks come out ahead, but there are few cases of major asymmetries and little cause for wholesale reassessment of U.S. banking policy because of international competition. Rather, given the expansion and growing integration of world financial markets, U.S. policymakers need to build international considerations into their routine processes.

6. Governments and banks have special relationships all over the world. Regulatory and su-

pervisory policies aim at ensuring stability and protecting depositors. Governments implement monetary policy through the banking system, and, in some countries, use it to allocate credit and guide economic development.

With new technologies and new products making it easier for banks to circumvent the regulations that remain, and with competition inducing financial institutions to take greater risks in order to maintain their profit margins, *continued movement toward international coordination of banking regulations seems necessary to ensure stability*. The competitive trends analyzed in chapter 3 point to a need for ongoing discussions aimed at harmonization and coordination of regulatory and supervisory policies among major banking nations. The international regime for banking looks markedly underdeveloped compared with that for service industries like telecommunications. Indeed, despite the sensitivities raised by the special relationships between banks and national governments, it may be time to consider supranational regulation of financial services, rather than simply coordinated national policies.

Engineering and Construction

While international banking has been growing, the international E&C market has been shrinking (ch. 4). Falling oil prices and Third World debt burdens marked the end of a period of vast international projects, one that brought abundant opportunities for both American and foreign E&C firms. Today, foreign contractors often have technology as good as—in some cases, better than—American firms. European and Japanese contractors have pioneered new approaches to tunneling and reinforced concrete construction. South Korean construction companies learned their trade in Vietnam and the Middle East during the 1960s and 1970s, often working alongside American firms.

The result? More competition for fewer projects, and a difficult environment for U.S. contractors, who no longer have outstanding technological advantages to set against their high labor costs. Foreign government subsidies—notably tied aid credits—aggravate the situation. Major international contracts often turn on financing packages. Many foreign governments participate in assembling these packages; by and large, the U.S. Government does not. For the E&C industry, the competitive future resembles that for the Nation's smokestack manufacturing industries more than that for most other traded services.

1. Since the 1970s, *U.S. E&C firms have been losing ground steadily in international markets; they will probably continue to suffer from gradually declining competitiveness*.

During the Middle East construction boom of the 1970s, U.S. firms did well, but nonetheless saw their share of international projects fall. Other countries took growing shares, and continue to do so. Third World debt means fewer of the large and complex projects for which American companies have had competitive advantages. Growing technical capabilities in the Third World mean fewer jobs for outsiders. E&C firms with headquarters in the LDCs and NICs as well as other industrial nations offer stiffer competition for projects that do come onto the international market. As a result, U.S. market share has declined faster in the 1980s. Indeed, foreign firms have begun to make startling inroads into the U.S. E&C market; figure 5 shows the rise in new U.S. contracts of foreign construction firms—a rise that has taken place during a period when the value of new construction in the United States has declined somewhat.

2. As in many manufacturing industries where U.S. competitiveness has slipped, the reasons begin with economic growth elsewhere, coupled with improvements in overseas technology and managerial ability. That is not to say the U.S. industry is problem-free; *in general, U.S. E&C firms—and construction companies more than engineering and design firms—have yet to come to grips with their shifting competitive circumstances*. Adjustments to new realities have been slow, responses more reactive than proactive; differences in attitude and outlook between managements in American

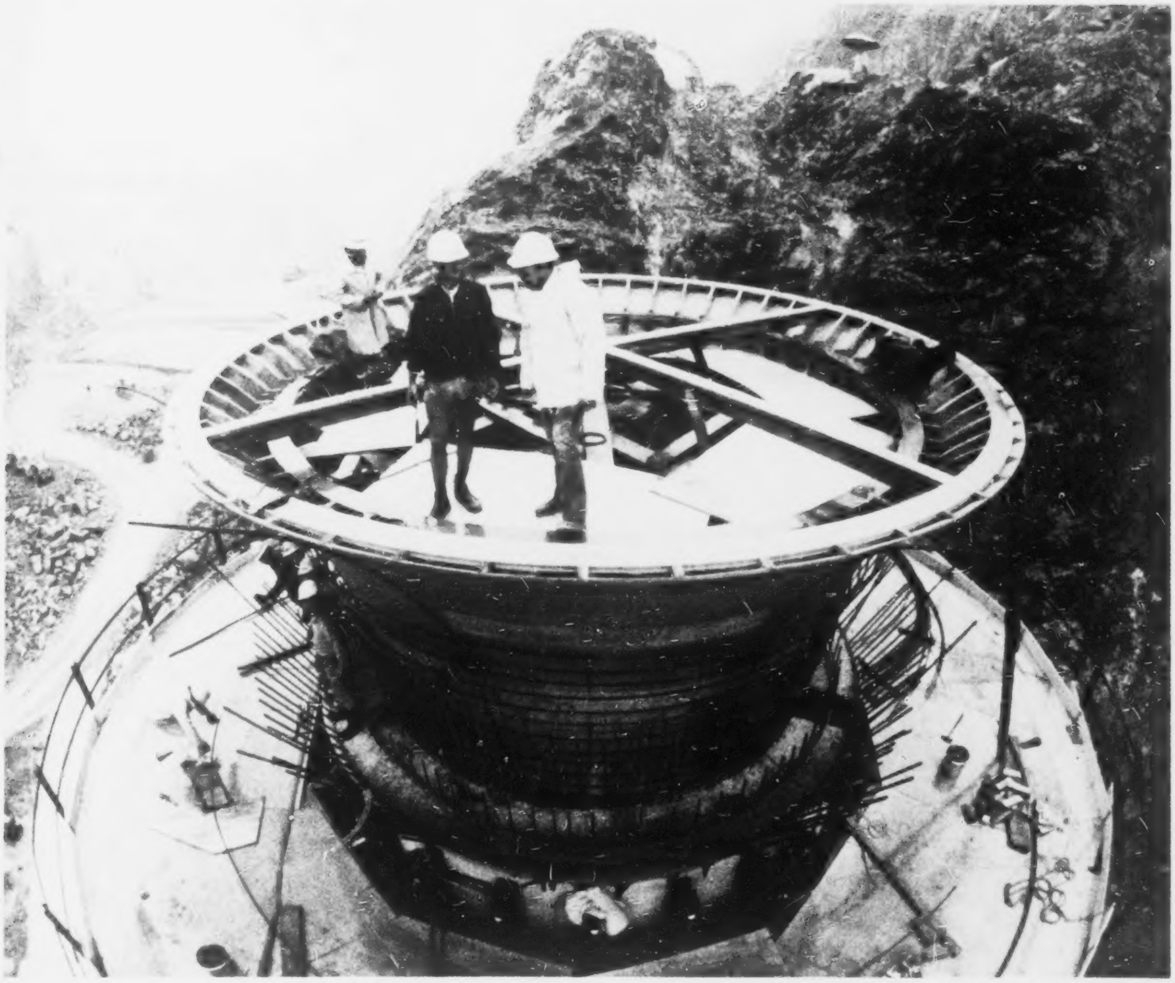


Photo credit: Bechtel Power Corp.

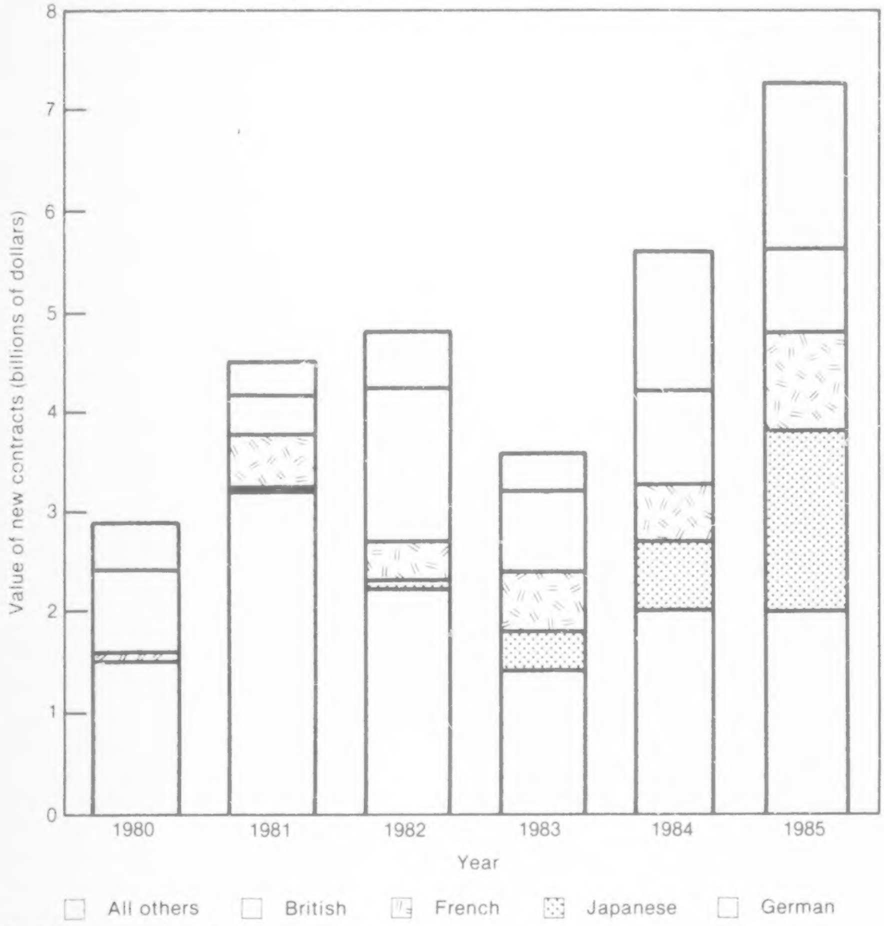
Construction on the $1 billion Ok Tedi Gold and Copper Project in Papua New Guinea

E&C firms and those in banks or data processing companies have been striking.

3. *Better utilization of existing technologies, and aggressive development of new technical know-how, could help American E&C firms maintain their competitive standing.* The United States is no longer a leader in a surprising number of technologies relevant for large-scale construction projects. While many U.S. firms retain a deserved reputation for skills in design and in the management of complex projects—aided by the broad U.S. lead in applications of computer and communications technologies—these skills no longer suffice for competitive advantage in bidding on many international projects.

Given high labor costs (which U.S.-based contractors try to reduce by hiring foreign nationals whenever possible), and limited assistance from the U.S. Government in arranging financing, American E&C firms appear to have little choice but to move aggressively in rebuilding their industry on a base of high technology. Thus far, however, few firms have taken decisive steps

Figure 5.—Construction Contracts Won by Foreign Firms in the United States



SOURCE: *Engineering News-Record*, various issues.

in this direction. The Federal Government could help by encouraging cooperative and joint R&D to strengthen the technology base for the construction industry, as well seeking more effective methods for transferring the results of government-sponsored R&D to industry. Cost-sharing by Federal agencies would help extend time horizons for R&D projects.

Construction remains craft-based and labor-intensive, with vast scope for productivity improvement through better technology. Given the size of the domestic industry, better productivity would have far-reaching impacts within the United States as well as internationally.

4. Project financing has always been an important element in international E&C projects. Many foreign governments help arrange financing packages, not only to assist their E&C firms but to attract follow-on export business. Favored techniques include tied aid and mixed credit subsidies, which the United States normally avoids. U.S. efforts to limit subsidies have included negotiations in the Organization for Economic Cooperation and Development (OECD), along with new mechanisms intended to help Federal agencies match foreign financing in an effort to keep other governments at the bargaining table. To the extent such efforts bear fruit, as they appear to be, U.S. firms will be on a

more even competitive footing. But, while a significant step toward equalizing the terms of competition, this by itself will not be sufficient to revive U.S. competitiveness in the E&C industry.

Other policy initiatives at the Federal level can also help U.S. firms—e.g., set-aside programs for U.S.-funded projects overseas (military construction, as well as construction for embassies and consulates). But the shifts in competitiveness visible in the international E&C industry are deeply rooted in technological change and international economic currents. *Federal policies can, at best, provide support for new strategic thrusts by the U.S. industry—thrusts that have yet to take shape—* they cannot reverse the forces leading to change in international E&C markets.

Information Technology Services

Along with banking, the cluster of sectors including telecommunications, data processing (DP), information services, and computer software—the IT services—has the greatest impacts on competitive prospects of other U.S. industries (ch. 5). Cheap and reliable international communications mean that an American engineer on site in a foreign country can tap into the piping design layout for a petroleum refinery, change a hanger, and calculate the seismic response in a few minutes. One set of computer programs manages the functions of the communications hardware; other software carries out the calculations. Some applications of IT services cut costs, as when a DP service bureau handles another company's health insurance claims. Strategic applications of IT services help firms create new products and enter new markets—for instance, a chemical manufacturer may tie customers into its computer network so they can place their own orders.

1. *Of the IT services, telecommunications and computer software are most important for U.S. competitiveness in other industries.* Multinational integration depends on global communications. Computer software helps firms in all industries control costs and develop new business strategies; software tools will be particularly vital in building a high-technology base for U.S. manufacturing. Today, engineers in many industries rely on software aids for design and development of new products; software then controls the factory equipment that makes these products.

Both the telecommunications and software sectors are growing rapidly. So is information services (e.g., electronic databases)—a relatively small and specialized sector today, but one that will take on much greater importance in the future. In contrast, the DP services industry has already matured; growth has slowed, in part because many companies that once purchased DP services now take care of much of their own computing.

2. Currently, American firms are highly competitive internationally in all four IT sectors. Their positions appear generally secure over the short to medium term, particularly in DP and information services. Telecommunications and software, for differing reasons, will be a good deal more volatile, and may demand the attention of policymakers.

Value-added data communications networks (VANs—including the computer networks that link banks together, and that tie airlines and travel agents) will grow rapidly. Commercial VAN services will become important tools for businesses both domestically and internationally, particularly smaller companies that cannot afford their own networks. Larger U.S. companies will want their own VANs, but will use services supplied by independent vendors for some purposes as well. Development paths will depend in part on regulations here and overseas. *To the extent that policymakers can shape regulatory environments that will speed the expansion of VANs, ensure the availability of VAN services to small businesses as well as large, and guarantee U.S. firms access to overseas VAN markets as both suppliers and users, American businesses of all types will be in a better position to compete internationally.*

U.S.-based software firms remain undisputed leaders in world markets. Indeed, other governments have viewed the U.S. lead in software with a good deal of concern. Nations like West Germany have shifted government support from hardware (e.g., microelectronics) to software. Developing countries like Singapore and Taiwan emphasize software in their programs for catching up technologically. And of course Japan, with its heavily publicized fifth-generation computer project, seeks software that will help its computer manufacturers penetrate world markets more deeply. Why the focus on software? First, because of the cost-cutting and strategic applications for users almost anywhere in an economy. Second, because productivity in the generation of software itself has been nearly stagnant. Raising software productivity holds enormous promise for multiplying the productivity increments in other industries. Moreover, *U.S. competitiveness in computer hardware, and indeed in all high-technology industries, increasingly depends on software.* Today, software needs and availability often shape the design of hardware; indeed, software is often integrated into hardware (e.g., through functions embedded in semiconductor chips).

Rapid progress in automated software development could lead to shifts in international competitive standing. So could unexpected success in foreign projects such as Japan's fifth-generation effort. But the more likely outcomes of future competition will be gradual slippage in the U.S. position, particularly as foreign software firms move away from custom programming. Specially tailored software is expensive, and no longer a good solution to many customer needs. Cost pressures will drive countries like Japan toward the standardized applications packages pioneered by American suppliers. As foreign software companies begin producing standardized products, they will be able to compete more effectively with American suppliers. The Japanese, in particular, will become more competitive, if only because their rapid progress in hardware will force them to do better in software. *A narrowing gap between U.S. and foreign industries could prefigure a challenge in computer software not unlike past challenges in microelectronics.* Furthermore, better software in Japan—and in particular, programs that can deal efficiently with the complex character set of the Japanese language—will lead to major productivity increases *throughout* Japan's economy. Office automation is only the most obvious example.

3. Neither the fragmentation of responsibility for U.S. international telecommunications policy, nor foreign government policies—including the much-discussed possibility of restrictions on transborder data flows (TBDFs)—have, as yet, had major competitive impacts on U.S. businesses operating internationally. But with American firms of all kinds increasingly dependent on telecommunications, *Federal agencies with both domestic and international responsibilities will have to make impacts on competitiveness a normal and routine, rather than extraordinary, element in the policy process.*

As more American companies do business in more parts of the world, negative impacts of NTBs affecting telecommunications and related IT services become a more serious prospect. TBDF restrictions, onerous rate structures within particular countries, discriminatory access to network facilities--any of these could harm U.S. competitiveness in a broad range of industries. That the impacts have not been major ones in the past does not mean they could not become so in the future.

4. The next generation of telecommunications technologies—Integrated Services Digital Networks, or ISDN--will provide end-to-end digital communications for voice, data, and in some cases video signals. New services—e.g., computer networks—will be cheaper; eventually, any home or office that now has a telephone should be able to tap an information utility with a very broad array of available services. ISDN as an information infrastructure could parallel the Interstate Highway System in its impacts on the Nation's economy.

The capital costs of ISDN, however, will be enormous—hundreds of billions of dollars by the time, well into the next century, when international ISDN coverage becomes widespread. Technical standards will influence the costs, as well as the outcomes of competition involving equipment manufacturers, service suppliers, and users. *The stakes are very high.* Vast expenditures, and commensurate rewards to successful suppliers of equipment and services, will generate a great deal of conflict, both within and among the nations that design and build ISDN networks.

With different firms and different governments beginning to implement ISDN, the U.S. Government will face continuing decisions in international forums concerning technical standards, as well as questions of domestic regulatory policy. Given the tight control exercised by PTTs (post, telegraph, and telephone authorities, generally functioning as government monopolies) in many countries, negotiations over issues such as TBDFs and the international implementation of ISDN will probably go on for years. The costs of incompatibility in ISDN standards could be high, while the interests of equipment suppliers and user groups may differ substantially. As the U.S. position evolves, Congress may wish to review procedures for coordination among the many Federal agencies involved, and the specific preparations for standards-setting and related negotiations internationally. *Regulatory decisions in telecommunications, as in banking, have seldom reflected considerations of international competitiveness; in the future, they will need to do so.*

Before the AT&T breakup, many of these matters could be left to technical experts; today, with numerous companies competing to find an edge in the marketplace, matters of commonality, harmonization among systems, and standards demand high-level policy attention. The next several years could well be critical, with discussions planned within the International Telecommunication Union (ITU) that may have substantial implications for trade in telecommunications services as well as equipment. Congress, at several junctures, may wish to review efforts to develop and coordinate the U.S. position at these meetings and in GATT among the agencies involved (which include the Department of State, the Federal Communications Commission, USTR, and others).

5. *The United States might learn a good deal from close observation of foreign government policies affecting the IT services.* Both France's Teletel/Minitel system (which has put simple computer terminals in more than 2½ million homes and offices), and Japan's very ambitious plans for ISDN, hold considerable promise for stimulating development of new business activities—among both service suppliers and equipment manufacturers. Even if the U.S. Government continues to leave developments such as videotex totally to the private sector, insight into policies and outcomes overseas could help inform the regulatory decisions that will always be necessary here.

Technical Licensing

For years, the United States has been a source of technology for the rest of the world. Many American companies, mostly manufacturers, license not only patents, but knowledge and expertise (ch. 6). By value, most of these licenses go to affiliates—foreign joint ventures as well as the overseas divisions of U.S. multinationals —where control of proprietary know-how is easier than with an independent foreign firm.

In years past, many U.S. companies took their emerging Japanese rivals too lightly. Few would do so today; there is little evidence that American companies license their technology too cheaply—that is, that they continue to underestimate the risks of future competition from their licensees. But just because firms look out for their own interests does not mean they look out for their competitors' interests (or their suppliers' or customers' interests, or the national interest).

Today, the United States can also learn from the rest of the world. With overseas technology often as good as American, many more U.S. companies could benefit from seeking out and licensing foreign technologies. A more balanced two-way flow would be a positive sign for future U.S. competitiveness. Indeed, growth in U.S. licensing revenues has slowed since the beginning of the 1980s. This is one of many symptoms indicating that the vast base of technology underlying the Nation's commercial industries—particularly sectors well removed from defense needs—no longer adequately supports an economy as large and diverse as that of the United States. Coupled with indications of declining productivity in U.S. R&D, OTA's analysis suggests a real need for overhauling the Nation's technology policy.

1. U.S. companies license their technical knowledge primarily when other opportunities for exploiting it—exporting goods from the United States, direct investment in overseas manufacturing plants—have been cut off. Today, foreign governments use policies such as import barriers, investment incentives, and performance requirements more effectively than in the past to encourage transfers of technology to their own firms. *American companies have increasingly been forced into licensing agreements and joint ventures as substitutes for exporting or wholly owned foreign plants.*

U.S.-based multinational corporations (MNCs) have responded, in part, with integrated worldwide strategies in which licensing becomes an option to be bargained over from the beginning. The multinational may, for example, try to lock foreign partners into its proprietary technology through licensing, so that it will have at least a piece of the market, even though it cannot sell its exports. Or it may seek arrangements in which licensees will depend on purchases of components from the United States (e.g., advanced microprocessor chips). This is one of many examples of shifts in the international business strategies of U.S.-based firms where a sound analytical grasp by Federal agencies would aid in the development of negotiating positions during the Uruguay Round.

2. Given shrinkage or loss in the technological leads that so many American industries enjoyed a decade or two ago, some U.S.-based companies have become notably more aggressive in locating and acquiring foreign know-how through exchanges, joint ventures, or outright licensing agreements. Many others have yet to take such steps. *Federal policies—e.g., evaluation of foreign technical capability, critical reviews (as well as translations) of foreign technical literature, support for personnel exchanges—that encouraged inflows of foreign technology could help support the long-term competitiveness of many U.S. industries.* So could continued efforts by the Federal Government to ensure that the overseas affiliates of American firms have the right to participate in government-supported R&D programs, and equitable access to results.

3. Rough parity among major industrialized nations has become the norm in many industries and many fields of technology. Increased inward licensing paints much the same picture as other indicators: U.S. technology is no longer broadly superior to foreign know-how. Indeed, American firms have fallen behind in a surprising variety of cases (as ch. 4 outlines for the E&C industry). Attributable as much to improved technical abilities in other parts of the world as to slow-down in the United States, this relative shift is most evident in industries well-removed from military needs and defense funding—in steel rather than computers, autos not aerospace. Many of the indicators, indeed, point to priorities for the development of commercial (i.e., non-military) technologies that are markedly higher in countries like Japan and West Germany than in the United States; table 1, for example, shows that both Japanese and German companies spend relatively more on R&D than American firms.

Given the breadth of the technology base that supports commercial industries, the services as well as manufacturing, *Congress may wish to consider major changes in U.S. technology*

Table 1.—Business-Funded R&D as a Percentage of Gross Domestic Product

	1972	1981	1983	1985	1986[a]
United States	0.99%	1.22%	1.32%	1.39%	1.42%
Japan	1.15	1.73	1.99	2.09	2.14
Federal Republic of Germany	1.08	1.46	1.56	1.64	1.69

[a] Estimated.

SOURCES: **1972:** *Science and Technology Indicators Basic Statistical Series—Volume B: Gross National Expenditure on R&D: GERD 1969-1982* (Paris: Organization for Economic Cooperation and Development, 1985), table 16; **1981-1986:** "FRG Institute Compares German, U.S., Japan Research Expenditures," *Europe Report—Science and Technology*, Joint Publications Research Service JPRS-EST-86-033, Nov. 6, 1986, pp. 25, 28, 31. Translated from *Technologie Nachrichten*, May 15, 1986. Original source, Battelle Institute, Frankfort.

policy. Such a reassessment might begin with the recent turn toward Federal support for basic research almost exclusively. In the past, government agencies provided a mixture of support for basic and applied research. But the path from basic research to the marketplace is long and tortuous; Federal support, if restricted to basic work (and particularly to research in science rather than engineering), may not aid U.S. competitiveness for many years, perhaps decades. Policy initiatives such as support for generic technologies (those that can help all firms in an industry), and better mechanisms for diffusing commercial technologies to the vast majority of American companies that are not technologically self-sufficient, could make a significant difference. The costs would be small relative to total Federal R&D expenditures.

4. Although Japan has licensed U.S. technologies extensively in the past, and NICs like South Korea are currently seeking U.S. know-how as part of their development strategies, *OTA has found little evidence that licensing by American firms has, in recent years, been counterproductive from the perspective of individual firms—i.e., that license fees have been too low*. Nor does it appear that U.S. companies have, with rare exceptions, licensed at any price technologies critical for their own longer term competitiveness. But firms look out for their own interests, not those of their competitors; moreover, in earlier years, many American companies plainly underestimated the capabilities of Japanese manufacturers.

Finally, when foreign governments combine restrictions on imports and investment to pressure U.S.-based MNCs into licenses either at arms-length or with joint venture partners, they may be able to help local companies buy technology more cheaply than would otherwise be possible. Regulating technology outflows holds scant promise as a U.S. policy alternative. It is corporations, not governments, that develop and control proprietary technologies. But government policies aimed at helping American companies learn from foreign know-how could aid in bringing inflows and outflows into better balance.

Domestic and Labor Market Implications

Despite the many differences among the services examined in this assessment, international competitiveness in all of them depends heavily on human capital. Production of knowledge-based services (and goods) requires skills and abilities, know-how and judgment, that will be supplemented but not replaced by emerging computer and telecommunications technologies (ch. 8).

Automation and productivity improvement cut into job opportunities in industries that utilize computer and telecommunications systems intensively. Nonetheless, to the extent that firms in industries ranging from shoes to chemicals, insurance to modular housing, can apply such tools effectively, "dematuration" processes will help preserve job opportunities for Americans over the medium term and beyond. Both domestic employment in better paying, more highly skilled jobs, and the position of U.S. firms in world markets, depend on the maintenance of a comparative advantage in the production of knowledge-based goods and services.

1. To the extent that the U.S. labor force remains a source of well-educated employees with skills needed by service firms, the Nation is likely to remain internationally competitive in most of the knowledge-based services. This, in turn, will help U.S. manufacturing industries maintain their competitiveness. It will also help support a tertiary service sector that can continue to create jobs for Americans who are badly educated or lack specialized skills—jobs that will, however, pay little and provide no more than limited opportunities for advancement.

To maintain their international competitiveness, American firms in many of the service industries, as in much of manufacturing, must be able to respond quickly and effectively to changing market needs (in terms of output level or product mix), new technological opportunities, the twists and turns of foreign government policies. Flexibility can come from new technologies, mostly computer-based. But it ultimately rests on a work force with broad and deep skills. *Both new technologies and a more highly skilled labor force will be needed if knowledge-based service industries are to adapt successfully to new competitive realities.*

2. In most of the service industries, exports and imports remain small compared to domestic consumption (or sales through foreign affiliates). *Employment levels in the services, therefore, do not depend very directly on trade.* Nonetheless, indirect effects can be important —e.g., employment created in service firms that sell to exporters (of goods or services). There are no good estimates for the value of services embodied in goods exports, or the numbers of jobs created. But it is possible to state that such jobs will, on the average, be relatively highly skilled and well paid—particularly for high-technology manufactured products, with their heavy inputs of knowledge (regardless of whether manufacturers produce these knowledge inputs internally or purchase them from service companies). Likewise, most of the direct employment benefits of foreign investment in the services accrue to the host country; thus investments in the United States by foreign service firms—e.g., Japanese or French banks with offices in New York or San Francisco—create jobs for Americans.

3. In searching for low costs and flexibility, American firms are increasingly turning to temporary and/or part-time workers. By supplementing a core staff with contingent employees, companies can adjust quickly to shifts in demand. (Temporary help services has been one of the fastest growing U.S. industries.) Part-time employees help firms with labor requirements that vary predictably to minimize costs—e.g., banks that need more tellers on Mondays and Fridays, or retail stores open evenings and weekends.

The steady rise in people taking part-time jobs involuntarily—because that is the only work they can get—suggests that underemployment is joining unemployment as a persistent U.S. economic problem. But greater numbers of Americans are also working voluntarily in part-time or temporary positions. This reflects, among other things, a labor force with increasing levels of education and skill and a greater number of largely autonomous people who can pick and choose their work (graphic artists, computer programmers, auto mechanics). With Americans starting as many as a million new businesses each year (including those that are unincorporated), self-employment and new small-business startups have become more popular choices. So has work in the underground economy.

4. As the rise in involuntary part-time work suggests, together with the growing numbers of jobs that require credentials such as a college degree for entry, stratification in terms of income and career prospects will continue to increase within the U.S. labor market. Restructuring and applications of new technologies in many service firms have knocked the rungs out of internal promotion ladders. No longer can high school graduates enter an insurance company or a chain retailer and hope to move steadily upward in pay and responsibility. At least some college will be required for entry into many positions with prospects for upward mobility. Despite the rise of higher education over the last 25 years, then, *many Americans will find themselves stuck in low-paying service jobs with limited chances for advancement.* There seems little prospect that low-skilled, entry-level service jobs will ever lead to the long-term career earnings patterns characteristic of blue-collar manufacturing employment in the earlier postwar period.

5. Many recent immigrants into the United States, especially those entering illegally, take low-paying jobs in the tertiary services. But immigrants also cluster in skilled occupations such as nursing and engineering (service functions even if in manufacturing companies). *U.S. industry has come to depend on a supply of foreign-born employees—notably, engineers and scientists who choose to stay after com-*

pleting their education at an American university. To some extent, foreign nationals with technical training—who generally cannot qualify for security clearances—help balance the flow of U.S. citizens into defense-related industries.

Capable, well-trained people—regardless of field—will always be in demand. To the extent that immigrants add to the pool, they help U.S. industries compete.

6. Will the U.S. economy be able to draw on the human capital—the knowledge and skills—needed to create good jobs and support high living standards in the future? New technologies and new ways of doing business demand high-level skills—not only reasoning, problem-solving, and creativity, but interpersonal and social skills. And learning itself is a skill. In the emerging knowledge-based economy, *people will need to learn to work effectively in fluid and ambiguous environments, to accept responsibility individually and in groups—in many respects to behave more like managers even though they may not have jobs that are explicitly managerial.*

Higher-order problem-solving, good judgment, learning from experience—schools often pay lip service to these skills, but seldom try systematically to develop them. OTA's analysis suggests that preparation for work in the 21st century may demand a fundamental rethinking of the Nation's education and training system. Despite the attention focused on education over the past several years, there is little indication that such a reexamination has begun.

FEDERAL POLICIES

In the services even more than in manufacturing, government policymakers have seldom paid much attention to international competitiveness (ch. 10). This is changing, slowly. Congress has called for better coordination among the dozens of Federal agencies whose policies and regulations affect the services, and the Administration has begun to respond. Antitrust enforcement reflects the realities of international competition more strongly today than 10 years ago. U.S. persistence in GATT demonstrates that the highest levels of government have endorsed the goal of liberalizing trade in services.

Still, the United States has a long way to go to put its own house in order. Many of the impacts of regulatory and supervisory policies on international competitiveness occur indirectly; service industries ranging from insurance to air travel will remain more heavily regulated than typical manufacturing industries. Given the deregulatory fervor of the past dozen years, the policy shifts affecting competitiveness in sectors like banking or telecommunications have emerged from confused and confusing debates (such as that over non-bank banks, or deregulation/re-regulation of the telephone system). The complexity of technology and business practices in such industries makes it difficult for policymakers to grasp the issues; indeed, deregulation, falling back on the magic of the marketplace, has sometimes been little more than an admission of this failure. But withdrawal as well as intervention has competitive consequences, and good policy choices demand insight into these consequences. American business, with some exceptions, has adapted relatively quickly to immersion in a world economy rather than a national economy. American government, which remains primarily attuned to domestic needs and domestic interests, has not.

Other governments face the same problems: linking domestic policies and foreign economic policies; linking the problems and needs of service industries and manufacturing industries. Some have responded better than the U.S. Government, some worse. The more successful governments—and particularly those that have learned to shape market outcomes with some effectiveness—pose yet another test for the United States. When other countries take this tack, the stakes go up in trade negotiations. Yet the lack of planning capability and institutional

Photo credit: Walt Disney Productions

U.S. travel and tourism exports came to $13 billion in 1986.

memory in Federal agencies mean that sometimes U.S. policymakers may not even realize what is at issue.

Tables 2 and 3 summarize the policy options discussed in chapter 10, with table 2 providing an abbreviated guide to the 33 options and table 3 treating them in more detail. (Both appear in chapter 10 as well. Table 2 is the same as table 55, while table 3 condenses material found in tables 56, 57, 59, 60, and 61.) While many of the options deal with the specifics of particular government programs, the overall focus is on the capability and effectiveness of the policymaking system as a whole.

The first group of options (1-11) are concerned with U.S. trade policy. The subjects range from negotiating approach and objectives during the Uruguay Round, including the resource needs of the agencies involved, to the United States and Foreign Commercial Service (which looks understaffed alongside export promotion efforts by competing nations). In this group of policy options, OTA stresses the need to adequately support the Uruguay Round negotiations, which promise to be more involved and complex than previous MTNs, and beyond this to build better analytical capability into the structure of U.S. policymaking. Deeper engagement in world trade brings greater needs for coordination and planning among agencies, for clear thinking about U.S. interests and U.S. negotiating objectives.

The analysis underlying the next set of options (12-17) draws on the banking and telecommunications industries to illustrate the need for linking domestic policies—particularly regulatory decisions—with international competitiveness. Many agency policies affect the competitiveness of U.S. firms, but the system contains few mechanisms for taking account of potential impacts. Specific options here range from new Industry Sector Advisory Committees (for providing input to U.S. trade negotiators) to an office on banking competitiveness in the Treasury Department (or in another Federal agency with responsibilities for financial services).

OTA's analysis of competitiveness in the services, like past analyses of manufacturing, shows that international competitiveness has deep domestic roots, and that domestic policies—for example, dealing with education and training —have a great deal of influence over competitive outcomes. The human resources policy options (18-24) focus on adult education and training—covering questions such as educational technologies that might help build a more flexible and better-skilled work force. OTA also stresses the need to seek answers to questions such as: Will tinkering with the education and training system do the trick? Or must the United States seek fundamental changes in its educational practices to maintain competitiveness in high-value-added services and goods during the next century?

When it comes to technology development, policy choices spread well beyond the service

Table 2.—Summary Guide to Policy Options

Issue Area	Option	Relevant service sector
I. The Services and U.S. Trade Policy		
A. NEGOTIATING OBJECTIVES		
—Congressional guidance	1	all
B. COORDINATION OF SERVICES POLICY		
—Oversight on coordination of trade negotiations	2	all
C. TRADE ANALYSIS AND DATA		
—Long-term analysis for trade policy and planning	3	all
—Oversight on collection of services trade data (also see Option 12)	4	all
—Improving the data on trade in services and on technical licensing	5	all; licensing
D. SUPPORT FOR THE NEGOTIATIONS PROCESS		
—Staff and budget for USTR and other agencies	6	all
—Service sector advisory committees (also see Option 16)	7	all
—Continuing evaluation of U.S. and foreign regulations that act as non-tariff barriers	8	all
E. OTHER TRADE-RELATED ISSUES		
—Overseas promotion of exports	9	primarily E&C
—Tied aid and mixed credits	10	primarily E&C
—Trade and Development Program (TDP)	11	primarily E&C
II. Linkages Between Domestic Policies and International Competitiveness		
A. EXAMPLES FROM BANKING AND FINANCIAL SERVICES		
—Data on international trade in banking	12	banking
—Office on international impacts of banking policies	13	banking
—International coordination of regulations	14	banking
B. EXAMPLES FROM TELECOMMUNICATIONS		
—Negotiating objectives	15	telecommunications
—Advisory committee on telecommunications negotiations	16	telecommunications
—Institutional mechanisms for addressing impacts of domestic policies on competitiveness	17	telecommunications
III. Human Resources		
A. EVALUATION		
—Fundamental reexamination of human resources policies as they affect competitiveness	18	all
B. ADULT EDUCATION AND TRAINING		
—Demonstration projects for training/retraining of the active work force	19	all
—Increasing the national commitment to education and training of active workers	20	all
—Postsecondary vocational/technical curricula	21	all
C. INSTRUCTIONAL TECHNOLOGY		
—Inventory of federally developed training materials	22	potentially all
—Transfer of federally developed training methods, procedures, and course materials	23	potentially all
—Funding for research, development, evaluation, and dissemination of instructional technologies	24	all
IV. Technology Development		
A. R&D IN THE SERVICES		
—Improving Federal Government data	25	all
B. THE U.S. TECHNOLOGY BASE		
—Federal support for commercial R&D	26	all; E&C
—Technology diffusion to industry	27	all
—Implementation of Japanese Technical Literature Act	28	all
—International exchanges of technical personnel	29	all
—Equitable access to foreign technology	30	all
—Analysis of impacts of defense-related R&D on U.S. competitiveness	31	all
C. TECHNICAL STANDARDS		
—Federal testing and demonstration facility for ISDN	32	information and telecommunications; indirectly all
—Preparation for upcoming meetings of the International Telecommunication Union	33	information and telecommunications; indirectly all

SOURCE: Office of Technology Assessment, 1987.

Table 3.—Issues and Options for Congressional Consideration

This table (which condenses material from tables 56, 57, 59, 60, and 61 in ch. 10) presents the 33 policy options in self-contained form. Ch. 10 discusses them in detail.

Issue	Options for Congress	Comments
ISSUE AREA I—THE SERVICES AND U.S. TRADE POLICY		
A. Negotiating Objectives		
While negotiators need flexibility, close continuing contact with Congress is essential if the Administration is to secure a trade agreement acceptable to the legislative branch.	OPTION 1: While the Uruguay Round is in its early stages, Congress could provide specific guidance to the Administration on the outcomes it views as most critical to U.S. interests. This could take forms including: • informal congressional consultations with USTR; • requiring formal consultation and reporting at several junctures before the Administration seeks congressional approval of new GATT agreements; • legislative statements of U.S. negotiating objectives, possibly including objectives for specific service sectors. This could involve amending the relevant portions of the Trade Act of 1974 (e.g., Sec. 104A, added in 1984 to define broad goals dealing with services trade, foreign direct investment, and trade in high-technology goods).	The new GATT round raises fundamental questions concerning the U.S. role in the world trading system—matters going far beyond possible GATT coverage of the services: • In what ways would a stronger GATT serve U.S. interests? • Will U.S. initiatives in services trade and other new issues—and in agricultural trade—serve to strengthen GATT as an institution? Will some of them and not others? • Other nations will inevitably seek concessions in exchange for agreements that U.S. policymakers view as important. What sorts of trade-offs is the United States likely to face as we move into the Uruguay Round? • How will U.S. negotiators assign relative priorities to goods and to services when conflicts between the two arise during the discussions?
B. Coordination of Services Policy		
Developing trade policies for services will require effective coordination among more than 30 Federal agencies (including numerous regulatory bodies) with responsibilities for services.	OPTION 2: Also at an early point during the Uruguay Round, Congress could conduct oversight (and provide guidance and direction where needed) on executive branch coordination of services trade policy, under Title III of Public Law 98-573. In particular, Congress might use the oversight process to determine whether coordination is adequate for ensuring consistent U.S. positions in GATT and the other international forums where sector-specific and specialized issues (e.g., intellectual property protection) will be discussed.	Title III of Public Law 98-573 gave USTR responsibility for developing and coordinating services trade policy, using the interagency Trade Policy Committee. Negotiations affecting trade in services may take place in other forums as supplements to or in parallel with GATT. Examples include OECD, the World Intellectual Property Organization, and the International Telecommunication Union.
C. Trade Analysis and Data		
Better analytical support would make for better U.S. trade policy. Long-term policy planning is a particular need.	OPTION 3: Establish a new office for trade policy analysis, to provide continuing analytical support and institutional memory for executive branch decisionmaking. The office could focus on support for day-to-day decisions, on longer term policy development, or both.	The primary reason for creating a new trade policy analysis unit, rather than simply providing more resources to an existing office, would be to place the new group close to policymakers—and to staff and structure it accordingly.
The current database on trade in services is seriously deficient.	OPTION 4: Conduct oversight on implementation of the International Investment and Trade in Services Survey Act (as amended in 1984) to determine whether some of the discretionary provisions for data collection should be made mandatory.	In Sec. 306 of Public Law 98-573, Congress amended prior law to give clear authorization to the President to collect data on trade in services. However, Congress left collection of services data discretionary.
Many of the needed improvements in services data would entail changes in procedures of the Bureau of Economic Analysis (BEA), the Commerce Department unit that compiles trade statistics. The Administration has failed to approve some BEA proposals. Without a congressional directive, delays may continue.	OPTION 5: Direct the Commerce Department to take specific action to improve data on trade in services. Possible steps include: • surveying service transactions between unaffiliated firms (by proceeding with the BE-20 survey or a modified version); • expanding the Census of Service Industries; • altering BEA procedures for presenting royalties and license fee data to distinguish technology from other categories of intangible property, and to provide data on numbers of license agreements by year, and on receipts and payments on new license agreements in a given year.	OTA discusses further steps for improving the database on services trade in its special report, *Trade in Services: Exports and Foreign Revenues*. Also see Option 12 on financial services.

Table 3.—Issues and Options for Congressional Consideration—(Continued)

Issue	Options for Congress	Comments
D. Support for the Negotiations Process		
Despite the growing number of issues on the Nation's trade agenda, budget and staff resources for negotiations remain modest.	OPTION 6: Expand USTR's budget and staff to meet not only the heavy continuing work load expected over the course of the Uruguay Round, but also to carry on planning and preparations for subsequent negotiations, including those in other international forums.	As part of this process, Congress could direct the Administration to compile and annually update a statement listing the contributions of all Federal agencies to U.S. trade negotiations.
If discussions on services trade move beyond the umbrella stage to sector-specific topics—and for such talks elsewhere—U.S. negotiators will need more input from service industries and their employees, and from users of services.	OPTION 7: Direct the Administration to establish several more Industry Sector Advisory Committees (ISACs) to speak for particular service industries, and several additional labor subcommittees to speak for their employees. To prepare for sector-specific talks—indeed, to help determine whether these would be desirable from the U.S. point of view—Congress could direct the Administration to establish and consult with the new advisory groups at an early date.	The trade advisory committee system authorized by Sec. 135 of the Trade Act of 1974 provides a mechanism for private sector input into trade negotiations. While an overall Services Policy Advisory Committee exists, only one ISAC (or two, counting that for wholesaling and retailing) represents the services at the sectoral level, compared with 14 for goods. (See Option 16 for discussion of telecommunications.)
Regulatory policies lie behind many of the barriers to services trade and investment, including regulations that serve important public purposes. Progress in reducing barriers will depend on willingness by countries to acknowledge and identify regulations that unnecessarily discriminate against foreign firms.	OPTION 8: Direct USTR (in cooperation with other agencies) to give high priority to evaluating both U.S. and foreign regulations that act, intentionally or incidentally, as non-tariff barriers to trade and investment in the services. By taking the initiative, the United States could encourage other major trading nations to examine their own regulatory barriers.	USTR reports annually to Congress on foreign trade barriers. The agency made a start on identifying U.S. regulations affecting trade in services when it prepared the U.S. national study on services, submitted to GATT in 1983. To reach agreements on reducing barriers to services trade, nations will first have to decide what topics are appropriate for discussion.
E. Other Trade-Related Issues		
Compared to many of its trading partners and competitors, the United States devotes only modest resources to export promotion abroad.	OPTION 9: Increase support for the overseas activities of the United States and Foreign Commercial Service (US&FCS), which is responsible for most of the overseas export promotion undertaken by the Federal Government. Raising the number of US&FCS officers overseas from current levels—about 200—to a complement of 300 or more would aid U.S. exporting in general. Congress could also direct the Service to provide training for its employees in the special needs and problems of the service industries.	Japan has about 5,000 overseas commercial officers; the United Kingdom and France each have 400 or more.
For years, the United States has sought to tighten a loophole in OECD guidelines on export credits that permits tied aid subsidies. In 1986, Congress authorized a tied-aid war chest as part of the Export-Import Bank Act Amendments (Public Law 99-472). Substantially tighter OECD guidelines followed in 1987.	OPTION 10: Since other governments can always find ways to subsidize exports that they judge important for national interests, Congress could make plain U.S. resolve to keep such practices under control by continuing the authorization for the tied-aid war chest—and by funding it to match foreign subsidies, if this seems needed to get other OECD members to hold to the new agreement.	
The Trade and Development Program (TDP) finances feasibility studies and planning services by U.S. firms for projects in LDCs. Some of these studies lead to further work for U.S. firms, or to exports of goods.	OPTION 11: Increase TDP support from its current level of about $20 million annually—much smaller than similar programs in several other nations. Congress could also direct TDP to raise the number of feasibility studies conducted by U.S. firms on a reimbursable or cost-sharing basis.	TDP has particular relevance for the E&C industry.

Table 3.—Issues and Options for Congressional Consideration—(Continued)

Issue	Options for Congress	Comments
ISSUE AREA II—LINKAGES BETWEEN DOMESTIC POLICIES AND INTERNATIONAL COMPETITIVENESS		
A. Examples from Banking and Financial Services		
Current data collection procedures fail to provide a clear picture of banking exports and imports.	OPTION 12: Direct the Commerce Department's Bureau of Economic Analysis to improve its database on international banking and financial services, in consultation with the Federal Financial Institutions Examination Council, and its member agencies (e.g., the Federal Reserve Board).	
Decisions made by the many Federal and State agencies that supervise and regulate banking can affect international competitiveness, creating a need to build consideration of these impacts into policymaking processes.	OPTION 13: Direct the Administration to provide an explicit mandate for an office of international competitiveness in banking to serve as a focal point for such issues, in particular the international ramifications of domestic policies.	Congress could direct the Administration to establish a new group, or to expand Treasury's existing Office of International Banking and Portfolio Investment.
Domestic authorities, here and in other countries, have been hard pressed to keep up with rapid changes in international banking and financial services. Greater international coordination of bank supervision and regulation may be needed, along with an expansion to cover securities markets.	OPTION 14: Use oversight and reporting requirements to begin evaluating alternatives for greater international coordination of banking policies. One possibility would be to direct U.S. agencies that serve on the Basel Committee to explore ways of expanding the Committee's present activities.	Congress could also direct Federal agencies to examine and report on the desirability of creating a new international body for addressing issues of international coordination and harmonization of regulatory and supervisory policies.
B. Examples from Telecommunications		
Restrictions on trade in both telecommunications equipment and services have hindered or halted the efforts of U.S. firms seeking to enter foreign markets.	OPTION 15: Congress could establish formal U.S. negotiating objectives for GATT and other forums dealing with telecommunications services and equipment.	Examples of possible objectives include: that U.S. firms be allowed to compete on an equal basis with host-country firms where foreign governments permit competition in telecommunications services; that, as users of foreign telecommunications services, U.S.-based firms not be subject to discriminatory terms, rates, and conditions.
To prepare for sector-specific negotiations on telecommunications, policymakers will need input from the full range of stakeholders.	OPTION 16: Direct USTR and Commerce (in cooperation with other Federal agencies involved in telecommunications policy) to establish an Industry Sector Advisory Committee on telecommunications. The ISAC should include representation for users of telecommunications services and employees of telecommunications firms, as well as service providers and equipment manufacturers.	Because the interests of equipment producers, suppliers of services, and users often diverge, it might be desirable to create three subcommittees reporting to a telecommunications ISAC.
Because telecommunications is a vital portion of the infrastructure for the world economy, government policies have competitive impacts not only for equipment manufacturers and service providers, but also for users (including many U.S.-based firms).	OPTION 17: Direct all Federal agencies with responsibilities for telecommunications to take into account in their regulatory and other decisions the interests of U.S. firms which are users of international telecommunications services, as well as suppliers of equipment and services. If Congress restructures the Nation's regulatory apparatus (e.g., by returning more authority to the FCC), it could take that opportunity to provide such directions.	It will be up to Congress, in the end, to redefine the roles of Federal agencies in telecommunications policy. Whatever the choices, it will be critical that the new structure give questions of international competitiveness high priority. Congress, for example, might give particular attention to the prospective role of the FCC, as an independent agency, in dealing with foreign governments and international bodies concerned with telecommunications.
ISSUE AREA III—HUMAN RESOURCES		
A. Evaluation		
Despite numerous commissions and task force reports, no consensus has emerged on adapting education, training, and other human resources policies to the new circumstances resulting from U.S. immersion in the international economy.	OPTION 18: Call for a fundamental reexamination of human resources policies, and an evaluation of specific steps to enhance the ability of Americans to adjust to shifts in labor market and workplace conditions resulting from international competition.	Congress could charter an independent council or institute to report and make specific policy recommendations. Or it could ensure that human capital issues get a prominent place in the mandate of any council or other body established by Congress to examine and make policy recommendations on international competitiveness.

Table 3.—Issues and Options for Congressional Consideration—(Continued)

Issue	Options for Congress	Comments
B. Adult Education and Training		
A work force with good skills is essential for maintaining U.S. competitiveness. While some companies provide broad-based education and training for their employees, others do little or nothing.	OPTION 19: Direct the Administration to undertake pilot and demonstration projects, in cooperation with business and industry, on new approaches to training and retraining of active workers. Involvement by organized labor would also be desirable. Such programs would not require new authorization.	In its 1986 amendments to JTPA (Public Law 99-496), Congress authorized the Secretary of Labor to fund pilot projects for training, while the Carl D. Perkins Vocational Education Act of 1984 (Public Law 98-524) provides for a special State grant program for adult education and retraining.
Demonstration projects alone will not lead to major increases in training for employed adults.	OPTION 20: Consider alternatives to increase the national commitment for training and retraining of the adult work force, including incentives for employer-provided education and training and new sources of funding.	Proposed alternative funding mechanisms have included tax credits for firms that provide certain kinds of training, and a payroll-based tax to fund retraining services for workers.
General vocational curricula that would provide a foundation for continuing (re)training could help people in the knowledge-based industries adapt to future workplace changes.	OPTION 21: Direct the Department of Education, in cooperation with the Department of Labor, to fund demonstration projects for broad-based vocational curricula, focusing on generic skill development for the knowledge-based services. Grants could be made available to both public vocational-technical schools and proprietary (trade) schools.	Business and industry should be actively involved in any such experimental and demonstration projects. The Carl D. Perkins Vocational Education Act of 1984 provides a suitable vehicle for this option.
C. Instructional Technology		
The Federal Government has developed a great deal of technology and instructional material for training. Some of this could be useful to the private sector and the schools, but only limited information has been easily available to educators and private sector trainers.	OPTION 22: Direct the Administration to give priority to timely completion of the feasibility study for an inventory of federally funded training software called for by the Federal Technology Transfer Act of 1986. Should it seem appropriate once the feasibility study has been completed, direct the Administration to proceed with the inventory.	Congress called for the feasibility study in the Federal Technology Transfer Act (Public Law 99-502), which amended the Stevenson-Wydler Technology Innovation Act of 1980 (Public Law 98-480).
Transfer of training technology from the government to schools and to the private sector may involve several agencies, as well as requiring modifications to course materials.	OPTION 23: Instruct Federal agencies to place more emphasis on transfer of training technology and course materials to public institutions and corporations, initially through technology transfer mechanisms as authorized in Public Law 96-480. Congress could follow with oversight to determine whether new mechanisms should be created specifically for diffusion of training technologies.	Examples of executive branch efforts to transfer training technology include a computer-assisted reading program developed by the Navy and transferred to some libraries.
Realizing the long-term potential of instructional technology will require continuing research on teaching and learning. Beyond R&D and the development of new teaching and training materials, dissemination of new methods—including computer-based training—will require ongoing Federal support.	OPTION 24: Increase funding for research, development, evaluation, and dissemination of instructional technologies—including adult education and training. One approach would be to direct the Department of Education to establish and provide partial funding for a research center concerned specifically with adult learning, and including R&D on instructional technologies.	Federal funding for such a program could be kept modest by requiring matching grants from foundations and the private sector, which stands to benefit substantially. Congress, in the Higher Education Amendments of 1986 (Public Law 99-498), called for a national program of research on adult learning—without, however, authorizing funding.
ISSUE AREA IV—TECHNOLOGY DEVELOPMENT		
A. R&D in the Services		
OTA finds U.S. R&D related to services to be much greater than reported in the usual Federal Government data series.	OPTION 25: Direct Federal agencies—specifically, the National Science Foundation—to develop new criteria for identifying and collecting information on R&D and technology development related to the services.	Services R&D has been underreported for reasons similar to those for the underreporting of services trade in the U.S. current account—outdated and unexamined procedures, many of which simply omit service activities.

Table 3.—Issues and Options for Congressional Consideration—(Continued)

Issue	Options for Congress	Comments
B. The U.S. Technology Base		
The services depend on much the same technology base as manufacturing. Leaving aside national defense, the Federal Government provides relatively little funding for technology development.	OPTION 26: Increase Federal R&D support for commercial (i.e., non-defense) technologies by expanding initiatives such as NSF's Engineering Research Centers, and ensuring continued funding for existing programs such as the Center for Building Technology at the National Bureau of Standards.	
Congress has called for more emphasis on diffusion of technology to American industry through such laws as the Stevenson-Wydler Act (Public Law 96-480). The Administration, however, has only implemented parts of the legislation.	OPTION 27: Alternatively or in addition to the steps in Option 26, Congress could, under the 1986 Federal Technology Transfer Act (the 1986 amendments to Public Law 96-480), authorize, provide funding for, and direct the Administration to offer grants for Centers for Cooperative Research. For greatest effectiveness, these centers should be charged with technology diffusion as well as development.	Should Congress choose to create an Advanced Civilian Technology Agency or National Technology Foundation—as has been proposed in a number of bills introduced in recent years—cooperative technology centers would fit naturally into its role and function. Technology diffusion programs could be cost-shared between the States and the Federal Government.
The United States, no longer the unquestioned leader in technical knowledge, will need to do a better job of learning from foreign technology in years to come.	OPTION 28: Emphasize congressional commitment to implementation of the Japanese Technical Literature Act of 1986 (Public Law 99-382) through early oversight and full funding. If Congress wishes to place more emphasis on screening and evaluation, or to direct the Administration to fund translations of interest to university-based researchers, it could direct the Commerce Department to share responsibility with agencies having more experience in technology and science—e.g., the National Science Foundation.	
	OPTION 29: Increase support for exchanges of U.S. technical personnel with those of other nations. Congress could fund fellowships that would send graduate students in engineering to countries like Japan, as well as considering programs that would provide partial support, in conjunction with employers, for industrial engineers and scientists working abroad temporarily (in industry or in universities).	Sending more engineers and scientists to work temporarily abroad could help change corporate attitudes in the United States, and would give American industry more rapid access to foreign technologies as they emerge.
	OPTION 30: Make equitable access to foreign technology a formal U.S. negotiating objective, and call for reductions in restrictions on access for U.S. citizens to publicly supported R&D projects in other countries.	Pursuit of this objective (included in H.R. 3 as passed by the House in May 1987) would need to be consistent with U.S. policies on foreign access to results from government-supported R&D projects here.
Policy adjustments may be needed to capitalize on the potential of defense spending for enhancing the competitiveness of commercial industries.	OPTION 31: Investigate and evaluate policies for maximizing the positive impacts of defense-related R&D and procurement on the international competitiveness of American industries.	Analysis of the linkages between the military and civilian sides of the economy might also lead to policy changes making it easier to adapt commercial technologies to military systems.
C. Technical Standards		
Before the AT&T breakup, a single company dominated the process of setting technical standards. Today, the process involves many firms in competition with one another.	OPTION 32: Direct the National Bureau of Standards (in cooperation with the National Telecommunications and Information Administration) to set up an ISDN testing and demonstration laboratory to help government agencies make purchasing decisions and take advantage of emerging technical capabilities, and to help pave the way for a smooth transition to ISDN in the United States.	NBS's Institute for Computer Sciences and Technology already has related work underway. An ISDN laboratory could provide independent assessments to support Federal procurement decisions, and also disseminate information to private sector users of telecommunications services.

Table 3.—Issues and Options for Congressional Consideration—(Continued)

Issue	Options for Congress	Comments
Developing U.S. positions at the ITU has become far more complex since the AT&T breakup. Future ITU deliberations may well define a global framework for ISDN, with impacts on equipment sales as well as services.	OPTION 33: Congress could anticipate the possibility that incompatible standards for ISDN will be proposed both internationally and within the United States, and begin to take preparatory steps to address such issues. Specific actions might include: • oversight to review U.S. preparations and negotiating positions for upcoming ITU meetings (e.g., WATTC-88), and the implications for U.S. positions at GATT and in other trade negotiations dealing with telecommunications; • requesting a comprehensive study to review prospective ISDN standards and implementation, with a view to laying groundwork for future policy decisions (e.g., if it appears that U.S. telecommunications carriers might adopt dissimilar approaches that would be costly for users).	The State Department coordinates and presents U.S. positions at the ITU. The Department relies heavily on the private sector, through committees, for advice on U.S. recommendations concerned with standards.

SOURCE: Office of Technology Assessment, 1987.

industries (Options 25-31). Competitiveness in the services springs from a technology/science base much the same as that for manufacturing. This fact alone--which has not been widely recognized—means that strengthening the infrastructure for development and diffusion of a wide range of technologies could help both sides of the economy. Higher priorities for commercial technologies seem needed. Governments in countries like Japan pay much more attention to pre-competitive technologies that can help all firms in an industry. Indeed, Federal policies aimed at encouraging inflows of technical know-how from countries like Japan could help U.S. competitiveness.

Achieving a better balance between science and technology, and finding ways to maximize the benefits of military R&D and Federal procurement for commercial technology development would also help American companies in many industries maintain and strengthen their competitive ability. Among the services, the need for better technology is most obvious in E&C firms, but certainly not limited to them. The last two options (32 and 33) reflect the significance of technical standards for international competition. The standards set in international bodies sometimes shape competitive outcomes quite directly. Other governments frequently try to influence these decisions. ISDN standards, for example, could have far-reaching implications for future competition in both services and in sales of computer and telecommunications equipment.

Standards-setting activities provide one of many examples of issues that often become lost in the fragmented structure of U.S. policymaking. Of course, dispersal of authority has been intentionally built into the U.S. system. The immediate problem is whether the system as currently structured can respond to the new needs of the U.S. economy. These needs are plain enough. Over two decades, even less, a broad array of American industries has lost competitiveness internationally. With continued movement toward an interdependent world economic system, the pressures on U.S. industry will continue to build. Firms and industries adjust, because they must. Some companies have failed. Others have moved abroad. Many have adopted new technologies, reduced their employment levels. But will the policymaking system adjust? The stakes are high: U.S. living standards have already begun to decline.

Certainly there are signs of change in Federal agencies. Deregulation has been one response, the services initiative in GATT another.

Have the policy adjustments been fast enough? Has the system changed in the right direction? Will our rather disorderly apparatus, with many agencies sharing overlapping responsibilities, continue to prove adequate? If other nations follow the U.S. lead, deregulating more than regulating, opening more markets than they close, then the answer is probably yes. If, on the other hand, other nations rely more heavily on national industrial policies to guide development, learn to use these policy tools with some effectiveness (as the Japanese have already done), and pay only lip service to GATT discipline, the answer will probably be no. In the latter case, the U.S. system—where structural adjustment as a policy goal has never been legitimated, and trade policy remains an appendage—will be a grave handicap.

If other nations do take the route of greater government involvement in economic affairs, then the United States may have little choice but to follow. If we do not, many of our remaining advantages—for example, in the information technology services—may slowly dissipate. Other governments will continue to extract concessions from U.S. businesses, and help their own firms chip away at U.S. markets. Telecommunications services and equipment illustrate many of the problems. Trade friction has been high for years. Repeated efforts to reach agreements on subsidies and "targeting" have come to little. Disputes will certainly continue. The European nations—where government ownership of PTTs is the rule—have embarked on extraordinary measures to promote technological development in computing and communications systems, while simultaneously trying to limit competition and protect jobs. Trade friction with Japan over telecommunications will continue as well, with the difference that Japanese policies have been more far-sighted than those in Europe—easier, given low unemployment rates, a single dominant political party, and a huge trade surplus. Meanwhile, the stakes have been going up, as the next generation of telecommunications technology—ISDN—begins to materialize. Thus far, some of the European nations, as well as Japan, have taken at least tentative steps toward deregulation, following the U.S. lead. Yet this primary difference remains: the United States has deregulated for domestic reasons; other countries have made their choices for reasons including international trade and competition. Leading exporters like West Germany and Japan have built consideration of impacts on trade and competition into their policymaking structures. They have many years of experience, often painful, in learning to use government policies to aid their country's businesses internationally. The United States has never had such a trade (or competitiveness) policy. Through most of the 1970s, at least, there seemed no need.

Over the postwar period, the United States sought, in many ways, to help other nations develop economically. By and large, these efforts have been successful. U.S. leadership helped ensure open international markets for trade and investment. Seven rounds of multilateral trade negotiations have left tariffs at low levels; although NTBs have replaced many tariffs, the world economy is more open today than ever before. Technology has diffused widely; many nations have moved steadily up the ladder of development. The United States has achieved much of what it sought over the past 40 years. Unfortunately, many American industries are having trouble competing in the world U.S. leadership created.

* * *

The following section, the last in the chapter, expands on the introductory paragraphs of this summary, and prefigures portions of the analysis in the body of the report.

EVOLVING INDUSTRIAL STRUCTURE: SERVICES AND GOODS

To some, the service economy is an information economy, symbolized by communications satellites, computerized financial transactions, pervasive electronically based media. Other images center on more personalized service products—psychotherapy, schooling, fast foods.

Looking at the U.S. economy in 1987, some observers would predict a de-industrialized future, in which too many Americans will take in each others' laundry, while U.S. manufacturing industries continue to decline internationally. Others, looking at the same picture, see a high-technology, post-industrial future—a future filled with smart machines helping produce knowledge-based services as well as the familiar tertiary and personal services, and with other smart machines revitalizing the manufacturing side of the economy.

Despite the examples of satellites or cheaper overseas air fares, most of the images have a domestic context. Few people know much about markets for Eurobonds, or the technical licensing transactions through which U.S. corporations exploit their know-how overseas. Internationally, trade in goods gets far more attention than trade in services—no surprise, given the huge U.S. deficit in goods trade.

Much the same is true in other countries. Some countries opposed inclusion of the services in the Uruguay Round negotiations because they saw nothing to be gained. Others—including NICs like Brazil and India, the leaders of the group opposing the U.S. initiative—see more clearly the importance of services for continuing economic development, but think they will lose if forced to open their markets. Some countries have been more receptive, but the LDCs and NICs in general—most with relatively small service sectors—have been slow to recognize ways in which liberalization might work in their interests.

The Services and Manufacturing: Synergies and Interdependencies

In 1986, the invisibles account—direct exports of services plus income from U.S. investments abroad—contributed 38 percent of total U.S. exports. Within the invisibles account, however, investment income (e.g., remittances from foreign affiliates of U.S. firms) outstrips exports of services (e.g., banking services provided from the United States for customers abroad). The official U.S. balance of payments lists direct exports of services at some $49 billion in 1986, compared with $91 billion for investment income, and $222 billion for exports of goods.

OTA's own estimates, summarized in chapter 2, show that the official statistics seriously understate both imports and exports of services. While OTA's estimates indicate a surplus on services trade substantially greater than the official figures—$14 billion compared to $2.3 billion for 1984, the latest year for which data are available—even this surplus looks small compared to the Nation's deficit on trade in goods, $113 billion in 1984 (and $148 billion in 1986).[2] And sales by overseas affiliates of U.S. service firms exceed the Nation's service exports, probably approaching $100 billion in 1984. A foreign presence will continue to be more important for selling services than for selling goods, for reasons that lie in the nature of service products—many of which must be produced at or near the point of consumption. Easier and cheaper global communications will change this aspect of the services only slowly. Trade in goods, which can be shipped and stored, will remain much larger.

Still, many of the conventional distinctions between goods-producing and service sectors are breaking down, domestically and internationally, While the national accounts may draw a line between goods and services, companies need not. Many produce both, and sell them bundled together (although distinctions by division or line of business remain common). The firms that have emerged as major competitors in world markets for computers have succeeded largely because of their skills in providing services to customers—services that include systems integration, user training, and support and maintenance for software as well as hardware.

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[2] OTA places 1984 service exports at about $80 billion, with imports of $66 billion—figures that exclude banking and represent the midpoint of a relatively wide range. These estimates, like the official statistics, take no account of services embodied in goods shipments, which cannot be approximated even roughly. See ch. 2, as well as *Trade in Services: Exports and Foreign Revenues*, op. cit., p. 38. Service sales of foreign affiliates of U.S. firms for 1984 could not be estimated because the data were lacking, but OTA's midrange estimates for 1982 and 1983 came to $97 billion and $92 billion, respectively (p. 41).

Software, arguably a service and now accounting for the major share of user costs in large computer systems, also comes from a rapidly growing independent industry. And of course the computer itself produces nothing tangible; its function is service—whether helping process a company's payroll or designing airplane wings.

Competitive ability in producing services has thus become a powerful factor in determining international competitiveness in manufacturing. Service revenues may give a manufacturing firm a broader range of strategic options. The productivity of people within an organization who perform service functions helps determine the ability of a firm to compete in world markets. General Motors' competitiveness depends on its assembly line workers, and also on its engineers, accountants, and truck drivers. GM bought EDS because of the latter's expertise in data processing services. Finally, GM—along with other U.S. automakers—gets substantial profits from financing new car purchases. To take another example, RCA—once but no longer a computer manufacturer—owns the NBC television network, while also making TV sets and communications satellites (and marketing the services of its satellites). GE, which likewise withdrew from computer markets years ago, builds locomotives and also markets information services to banks; GE bought RCA more for its service businesses than its manufacturing capability. Other examples: large corporations raise their own funds on the commercial paper market, bypassing their banks. Meanwhile, banks and accounting firms develop and sell computer software. E&C firms occasionally take equity positions in facilities they design and build. Multinational enterprises compete in some realms, cooperate in others, through vehicles that include international joint ventures, co-production agreements, licenses and technology sharing agreements; for years, RCA received some $50 million annually in licensing revenues from Japanese manufacturers of color televisions—a sum comparable to RCA's profits from the manufacture of consumer electronic products.

Market linkages between services and manufacturing often drive expansion in both. Production and sales of video-cassette recorders (VCRs), almost all made in Japan, have expanded at high rates; much of the growth has been fueled by U.S.-produced "software" in the form of pre-recorded tapes. As the time lag between release of motion pictures in theaters and sales or rentals of cassettes has dropped, VCRs have become a more attractive purchase. Thus sales of hardware and software, one imported, the other produced domestically, grow hand in hand. Software likewise drives sales of personal and home computers (ch. 5).

The lines separating service occupations from manufacturing occupations blur just as do those separating service firms from manufacturing firms. Growing numbers of employees in goods-producing industries perform service *functions*—nurses, company librarians, machine repairers, inventory clerks, computer programmers—in support of others in the parent organization or customers on the outside.

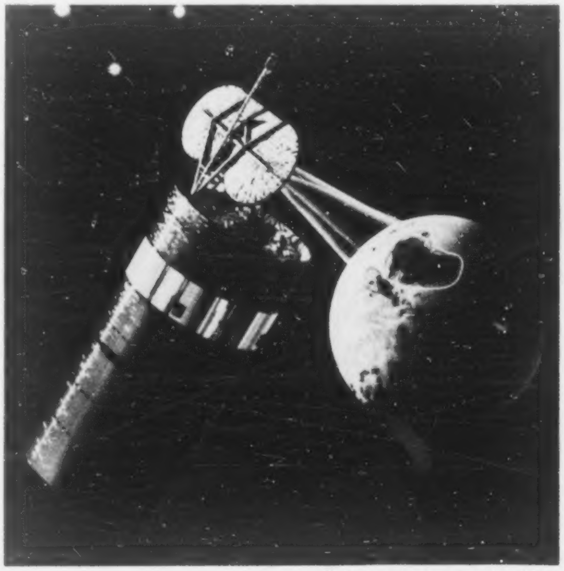


Photo credit: Hughes Aircraft Co.

AUSSAT, Australia's first communications satellite, built in the United States

Almost by definition, high-technology goods embody high service content in the sense of knowledge and expertise (an integrated circuit, a jet engine, a newly invented biological organism). Knowledge-based services (in contrast to the traditional or tertiary services—a later section outlines the distinctions) provide a critical part of the foundation and infrastructure for the production of high-value-added manufactured goods, where U.S. export strength has been greatest.

In their domestic operations, manufacturing companies rely on service firms not only for familiar business services like advertising, accounting, contract engineering, and public relations, but to operate cafeterias and clinics, provide security guards for offices and factories, and temporary employees to help meet surges in demand. Downstream from the factory, they depend on distributors and dealers. Japanese automobile manufacturers penetrated the U.S. market so deeply in part because they built up and nourished, over a considerable period, dealer networks which today are not only extensive but highly profitable for their American owners. In the steel industry, too, growth in distribution through service centers has helped change the terms of competition; much of the foreign steel sold in the United States moves through these independent suppliers. Finally, service firms not only sell to the manufacturing sector, but the Nation's manufacturing base provides much of the necessary support for a standard of living that leads to high consumption of personal services (restaurants, entertainment, travel), thus creating additional service-related jobs.

Service exports also create new export opportunities for goods: American E&C firms operating overseas often specify American capital goods (power generating equipment, industrial process control systems). Likewise, exports of goods lead to exports of services: contracts for training and maintenance may accompany sales of Boeing jetliners (with engines made by GE or Pratt & Whitney). More subtly, for U.S.-based multinationals to take advantage of new opportunities on a global scale, they must have reasonably open access to foreign markets, not only for sales of goods and services, but for direct investments. And to capitalize on the things they do best, American firms need an infrastructure that can support globally integrated business activities—an infrastructure supplying telecommunications services, financing, advertising, insurance, and the host of other concomitants of international business. This is equally true for multinationals that are primarily manufacturers (IBM, Caterpillar) and those that are primarily service providers (Citicorp, American Express). It is also true for those that are both: given the forces operating in the world economy, managers of many U.S.-based manufacturing companies are seeking to steer their organizations toward service activities (one of the factors behind the GE-RCA merger).

Multinational Expansion and Integration

At the end of 1985, U.S. direct investment abroad stood at about $235 billion. Motives for foreign direct investment range widely. Small manufacturers seeking low labor costs establish plants in Mexico or Malaysia. Global giants like Citicorp and IBM seek new and growing markets. Sometimes investment is reactive, as firms search for an accommodation to competitive pressures (e.g., rising imports at home); sometimes it is outward-looking and strategic. At one extreme, American manufacturers may respond to import competition by subcontracting production to local firms in low-wage countries. Logistical problems—communications, coordination, transportation—often bedevil these arms-length arrangements. At another extreme —multinational integration—companies can use data processing and communications networks to link farflung operations, solving many of the logistical problems of dispersed business operations. Today, it remains easier for large companies than small to put together well-integrated multinational organizations, but this will become more practical for smaller companies as the range of marketed services expands, experience accumulates, and costs come down. Already, many relatively small high-technology firms—e.g., software suppliers—operate on a multinational basis, seeking to expand at home and abroad in parallel. When U.S. software firms carry out product development in the United Kingdom, they do so not only to cut labor costs, but to be close to overseas markets. Later chapters explore the meaning of integration, and the implications for competition and competitiveness, in more detail.

Many U.S. Government policymakers, as well as corporate executives, see substantial benefits for the United States in multinational integration—benefits to which international agreements on services trade (and foreign investment) could make valuable contributions. In this view, such agreements, in GATT and elsewhere, emerge as highly desirable and perhaps essential for building U.S. competitiveness. Whether the businesses involved export from the United States or operate through overseas affiliates, services such as international telecommunications and data processing networks, or the foreign operations of American banks, seem vital. Indeed, some who take this view would argue that multinational integration provides the only feasible path for a country like the United States in an era of intensifying low-wage competition and rapid international diffusion of technology. OTA's analysis, in any event, suggests that maintaining high living standards in such a world requires a leading position in knowledge-based industries, services as well as manufacturing.

Despite their strategic significance, U.S. exports of services will continue to lag well behind goods exports (ch. 2). Continuing progress toward cheaper and more reliable telecommunications systems will alter processes that require production at the site of consumption only slowly. Nor can services, with few exceptions, be held in inventory, stored, or shipped overseas. Two implications follow:

- Employment in U.S. service industries does not depend heavily or directly on trade (either on exports, or on competition from imports).
- Foreign investment and sales through affiliates abroad will remain relatively more significant in the services than in manufacturing.

Nonetheless, rising service content in U.S. goods exports will help create new jobs for Americans, as will investment here by foreign firms seeking to sell services in the lucrative U.S. market. And, if most of the *direct* benefits (e.g., employment) of foreign investment accrue to the host country, services provided by U.S. affiliates abroad lead to indirect sources of advantage for other American industries. Moreover, many of the jobs created domestically in support of overseas investments tend to be relatively skilled and well-paying (e.g., technology development, financial analysis). For such reasons, U.S. international competitiveness in the services—and particularly in knowledge-based, high-value-added services—brings substantial benefits to the U.S. economy, though these may be indirect.

Thinking About the Services

In practice, lines are usually drawn so that the category labeled services includes nearly all economic activities *except* production of tangible goods. Regardless of the sharpness of the lines, or just where they are drawn, the service industries comprise a group at least as heterogeneous as the goods-producing industries, and perhaps more so; certainly, production of legal services differs as much from tourism as production of paper differs from production of computers. The categories in table 4 illustrate something of this heterogeneity.

The services listed in table 4 demand a wide range of inputs. The competitive ability of a given firm in a given country will depend on those inputs and their costs (see app. B, at the end of the report). A country like Mexico, with ample low-cost labor in addition to its beaches and sun, is well-placed to capitalize on tourist travel. Medical services, in some contrast, rely on highly skilled and highly paid workers, along with expensive capital equipment. Internationally, perhaps the most significant difference between goods-producing and service industries is this: goods can be exported, while service firms must generally maintain a foreign presence to sell in foreign markets. Foreign direct

Table 4.—Classification of Service Providers by Markets

I. **Intermediate markets (i.e., for services purchased primarily by business and industry)**
  Financial services
  - Banking (including investment banking and brokerage)
  - Insurance
  - Leasing

  Shipping and distribution
  - Ocean
  - Rail
  - Trucking
  - Air freight
  - Warehousing, distribution, wholesale trade

  Professional and technical
  - Technical licensing and sales
  - Architecture, engineering, and contruction (including engineering design services, architectural design, construction management, and contracting)
  - Management services
  - Legal services
  - Accounting

  Other intermediate or business services
  - Information technology services (including software, telecommunications, data processing, and information services)
  - Franchising
  - Advertising
  - Other (commercial real estate, business travel, security, postal and courier services, contract maintenance, . . .)

II. **Services provided largely in final markets to private citizens**
  - Retail trade (including restaurants)
  - Health care
  - Travel, recreation, entertainment
  - Education
  - Other social services, including government
  - Other personal services

SOURCE: Office of Technology Assessment, 1987

investment may be desirable in manufacturing; it is essential in many of the services.

In this assessment, intermediate or business services (category I, services produced and sold to other businesses) get most of the attention. With some exceptions in "other" services, as well as in shipping and distribution, most of the intermediate services in table 4 are knowledge-based and skill-intensive—i.e., they depend on technology. The second category (services provided largely in final markets to private citizens) also includes high-skill, high-wage, and technology-dependent industries such as health care, along with a variety of "low-technology" services.

Plainly, all such distinctions remain arbitrary. Banks employ many tellers with relatively low skills and low pay. Familiar industries—retailing and advertising, tourism and transportion, architectural design—depend on a continuous stream of technology-intensive innovations (automated inventory and ordering systems, computerized reservations and ticketing, computer-aided drafting, database management systems for engineering changes and bills of materials). American banks move funds around the country and around the world via electronic networks. Computer systems provide analytic support for decisions made by air traffic controllers and bank officers. In many of these applications, computers *enhance* human skills (e.g., by helping people deal with complexity in rapidly changing environments). In other applications, computer systems rationalize production in far more mechanistic ways—examples include automated warehouses and the back offices of banks, where huge volumes of checks must be processed quickly and cheaply. Here, the systems tend to *replace* human skills, as well as augmenting them in the sense of helping people do straightforward jobs faster.

Broadly speaking, technology is so pervasive in advanced economies that most foreign sales by U.S.-based companies, whether provided through exports or foreign affiliates, depend in some sense on technical expertise. Moreover, the services provided in conjunction with sales of goods such as commercial aircraft, or computer and telecommunications systems, follow directly from the technology embodied in the goods—e.g., training in servicing procedures for jet engines, or in maintaining systems software. At various points in this assessment, then, *knowledge-based* services are distinguished from more traditional or "*tertiary*" services, the latter including such industries as trade and distribution. Table 5 summarizes the distinctions between knowledge-based and tertiary services, while table 6 reclassifies service industries on this basis.

Like the classification by markets in table 4, ambiguities and exceptions can be found in table 6, but the distinction between knowledge-

Table 5.—Characteristics of Knowledge-Based Compared to Tertiary Services

Knowledge-based services	Tertiary services
High *skill* levels (as measured, for example, by years of education) and relatively high *pay*. Many professional and paraprofessional jobs. Continuing learning often important.	Low *skill* levels and educational requirements; low *pay*. Upward mobility may be quite limited.
Either the product or the production process, or both, depends on relatively advanced technologies. In many cases, digital computers have become integral to the production of the service (data processing itself, computer-assisted architectural drafting). Typically, computers are used to *enhance* people's skills. Control over the system (and the production process) may be distributed through the organization.	While advanced technologies may have a prominent role in the product/process environment, in general neither the nature of the service nor the nature of the production process is affected by the technology in a fundamental way (electronic cash registers as direct replacements for electro-mechanical; food preparation using pre-programmed equipment). Typically, the computer serves to *replace* human skills, with control concentrated at management levels.
Often though not always an *intermediate service*, supplied to other businesses.	Frequently a *service provided in final markets to individuals*, sometimes to businesses (custodial services, private security guards).
Provision of the service often demands rapid response to shifting customer needs. (It may begin with the elicitation of those needs.) Flexibility (in *volume* of output, in *design* of that output, hence in response to customer needs) may become a major competitive weapon. Both product and process can involve substantial customization to meet market requirements, implying high information/knowledge content.	The service tends to be *standardized*, the production process more-or-less fixed and routine.

SOURCE: Office of Technology Assessment, 1987

Table 6.—Examples of Knowledge-Based and Tertiary Service Industries

Knowledge-based	Tertiary
Banking	Leasing
Insurance	Shipping and distribution (all, including wholesale trade)
Professional and technical (all)	Franchising
Information technology services (all)	Retail trade
Advertising	Travel, recreation, much entertainment
Motion pictures	Social services (some)
Health care	Personal services (most)
Education	
Government (some)	

SOURCE: Office of Technology Assessment, 1987

based services and the traditional or tertiary services helps identify sectors where a high-wage, high-skill economy like that of the United States can expect to be competitive internationally. At the same time, given the heterogeneity of the services, it makes little sense to speak of an economy being competitive in the services as a whole. Over time, just as in manufacturing, some service industries will gain internationally, while others lose.

Using Technology

U.S.-based service companies have often had technological advantages that translate into competitive advantages. Today, protecting those advantages is harder than ever. Goods, services, people—all carrying technology—migrate with relative freedom through a world economy that is largely open, with national economies interpenetrating one another, primarily through the activities of international businesses.

The technology and science base underlying the service industries, which centers on modeling of product designs and production processes, overlaps that for manufacturing (box B). While products and processes differ greatly between the services and manufacturing (and among the services), many of the techniques remain similar. Computer-based decision models for buying and selling stocks, to take a widely publicized example, find parallels in factory automation, as well as in management of telecommunications networks. When it comes to applications of computers and communications

Box B.—The Technology/Science Base for the Services

Narrowly defined, the technological foundation for the service industries begins with models, the more useful of them mathematical. These models abstract from systems, both simple and complex (the system could be a food store or an international currency market), helping people predict their behavior. For a simple example—which is not to say the modeling is simple—consider a retail clothing store, whose owner might want to determine desirable inventory levels and reorder intervals, staffing needs, whether it pays to open on Sunday. Seasonal selling patterns, predictions of local and national economic growth, even long-term weather predictions, might help him decide how many winter coats to order, whether to hire and train new staff in expectation of booming business, and whether to negotiate a 6-month bank loan to finance inventory or rely on a revolving line of credit. A related problem might be to locate a new store within a growing urban area. Predictions of growth patterns and concentration of future shopping activity would help the owner decide where to put the store, and how much rent he could afford.

Only in the simplest cases could the store owner expect a full and immediately useful answer to his questions, yet imperfect information and heavily qualified results, provided he understood their limitations, would help him guide the business. Mathematical modeling based on knowledge of the physical sciences normally gives more accurate results. When a manufacturing company relies on engineering models to predict the performance of a newly designed home air-conditioner—e.g., its energy consumption—the predictions will be close to actual performance. But they will not be the same, and critical decisions (whether the new design performs enough better than the old) will always depend on actual tests. Note that the air-conditioner manufacturer will also rely on models like those useful to the retailer—consumer buying habits, the economic outlook, seasonal weather forecasts, optimal inventory levels.

Technology, then, in the services as in manufacturing (and mining and agriculture), begins with a science base, eclectically assembled to meet the needs of the industry. The science base underlies the models. The next and critical steps consist in knowing which models to use for a given purpose, how to use them effectively, when to accept their predictions and when to disregard them.

Thus there is much more than modeling to technology in its broader dimensions: only in simple cases will the decision be automatic (the store will run out of canned peas next Saturday unless we reorder now). People make decisions based on what they know and can articulate—which includes the output of analytical procedures—combined with tacit knowledge, instinct, and intuition, some of which they will not even be aware of calling on. This is part of technology too, viewed as know-how and expertise. In this view, people embody technology, both individually and collectively.

In most of the services, knowledge traceable to the science base will be less reliable as a guide for decisions than in goods-producing industries. What people "know" but cannot necessarily explain becomes correspondingly more important. Moreover, it is collective know-how and institutional decisionmaking that count in determining competitive outcomes—while a bank will depend more heavily on the collective knowledge, much of it intangible, of its staff than a construction company or a manufacturer of air-conditioners (which does not by any means make tacit know-how unimportant for the latter).

Many of the models developed in the past for dealing with problems in manufacturing industries could be handled with paper-and-pencil mathematics. This was adequate for designing a DC-3, even a nuclear powerplant; complex calculations that can only be attempted on digital computers bring refinements, but only occasionally real technical breakthroughs. In the services, more of the models will exceed the limits of paper and pencil if they are to be useful. Many of the phenomena to be modeled—e.g., people's behavior—must be treated statistically. Typically, this requires processing a good deal of empirical data—one of the things computers do best.

Computers excel at storing and manipulating large volumes of data and information—orders and inventory levels in a chain of retail stores, financial transactions in banks. They can also implement complex algorithms for recognizing print or simple spoken language. Beyond these transactional applications, new analytical uses of computers, primarily for supporting managerial decisionmaking, are rapidly becoming important for competitiveness in the service industries (as discussed in box C). Companies that utilize such techniques effectively—i.e., rely on them when appropriate, disregard them when not—will come out ahead. As always, appropriate use of technology will depend on judgment and experience.

The Federal Government—for instance, in its compilations of R&D statistics, and in policies for R&D tax credits—has not fully recognized the technology/science base for the services. But that lack of recognition, and the perception that service companies do market research rather than R&D, should not be allowed to hide the extent to which service industries depend on the tools of mathematics and other sciences. Estimates in chapter 9 suggest that annual U.S. R&D spending related to the services totals perhaps $26 billion, more than 10 times the figure published by the National Science Foundation as representing U.S. nonmanufacturing R&D.

systems, the contrast between analytical applications, such as computer-based stock trading, and transactional applications, in which the system does little more than keep track of large volumes of information, yields further insights into the place of technology in the services. Box C amplifies on this contrast.

As box C suggests, new technologies change the ways in which firms organize work. Digital data—sometimes information, sometimes meaningless noise—already permeates firms in the advanced industrial economies. Even quite small companies depend on electronic databases, automated production control systems, telecommunications services. Software itself, a service by some criteria, a good by others, symbolizes many of the ongoing shifts. Sitting between the system and the people who use it, software tells the computers what to do, controlling the interactions between people and machines. Software and system designers help shape corporate organizations, the contours of jobs, the channels of power and influence within the firm. But software no longer consists exclusively of pre-determined programs with a fixed logical structure. With distributed computing and fourth-generation languages, software—and hence the system as a whole—becomes more fluid. As these new approaches evolve, computer-literate experts will lose some of their control over the configuration of the system; in principle, many people could gain at least limited ability to modify and customize the software they work with.

Given this ability to use computer technology—either to enforce conformity with rigidly structured work procedures, as in the back office of a bank (analogous to an assembly line), or to enhance people's independent problem-solving capabilities, as in the bank's front office or in a computer-aided design laboratory—a "new" manufacturing enterprise may look more like a knowledge-intensive service firm than an "old" manufacturing enterprise. A modern steel producer, utilizing ladle refinement, vacuum degassing, and argon gas stirring, followed by continuous casting, to produce high-strength steels with lean alloy content, will be heavily dependent on sophisticated control models to regulate melt chemistry, mold levels, and rolling practice. In a sense, such a facility may have less in common with a steel manufacturer still relying on 1960s-era technology than with a hospital laboratory that uses automated sensors, analytical instruments, and recording devices to perform an individually specified test series on blood samples. Two basic dimensions to the use of computer technologies in business organizations follow:

- information/knowledge content, the extent to which the firm depends, in its products

Box C.—Computer Applications in the Services

As noted in box B, the service industries use many of the same technological tools as manufacturing. Structural design for bridges, dams, and buildings—undertaken by E&C firms—does not differ fundamentally from structural design for aircraft or for artificial hip joints. In both, the laws of physics provide the starting point for design methodologies that, today, often include finite element codes for stress and deflection analysis—codes that can only be run on powerful computers. Designing an office building to minimize operating costs (e.g., for lighting, heat, and cooling), given constraints on floor area and construction costs, means calculations for heat transfer and thermal management. In the telecommunications industry, computers help find optimum solutions for network design problems.

But what about services like banking and insurance, not to mention retailing and fast foods? Today, not only may the corner grocery do its bookkeeping on a personal computer, but supermarket chains use simulations to find the right number of check-out lines for a given store. An international construction company can manage an onsite inventory of piping, valves, and fittings worth millions of dollars, with large savings in its costs. Of these three examples, the first and last can be considered *transactional*, meaning that the primary task for the computer system is to keep track of large volumes of data. While arithmetic and simple logic will be part of this—e.g., in bookkeeping—mostly the computer is managing information flows. The second example differs; it is an *analytical* application, meaning that the computer performs calculations using a mathematical model (box B). None of the simplifications typical in such models are allowed in bookkeeping, although analytical applications might well be part of the software for managing onsite construction inventories (e.g., procedures for minimizing materials handling costs).

Transactional applications as part of ongoing business operations tend to be simple in principle but demanding in practice, particularly when databases are large and rates of information flow high. Although originally developed to reduce costs and increase productivity by automating existing jobs, transactional applications also yield strategic advantages through better customer support and service. For example, some companies are beginning to locate terminals on the premises of their customers. Not only can the customers place orders at their convenience, they can use the system to track shipments and otherwise manage their inventory levels. Other examples include fundamentally new products such as the cash cards used in automated banking.

Analytical applications, which can be replete with empirical data representing human behavior in at least some of its random messiness, stem more directly from the technology/science base underlying the services. Drawing in some cases on social and behavioral sciences, the unifying element once again is mathematical modeling. Whether it is queuing theory (as in the supermarket example), linear or nonlinear programming (as in the well-known traveling salesperson and warehousing problems), or economic modeling (e.g., business forecasts), the models run on computers, often some of the most powerful machines available.

Like transactional applications, analytical applications of computers open up strategic alternatives but may also simply cut costs. The supermarket can predict not only how many check-out lines it needs, but how many checkers to call in as a function of the day of the week and the time of day. In many service industries, future international competitiveness will depend on both transactional and analytical applications of computer systems, and on telecommunications systems for linking these computers.

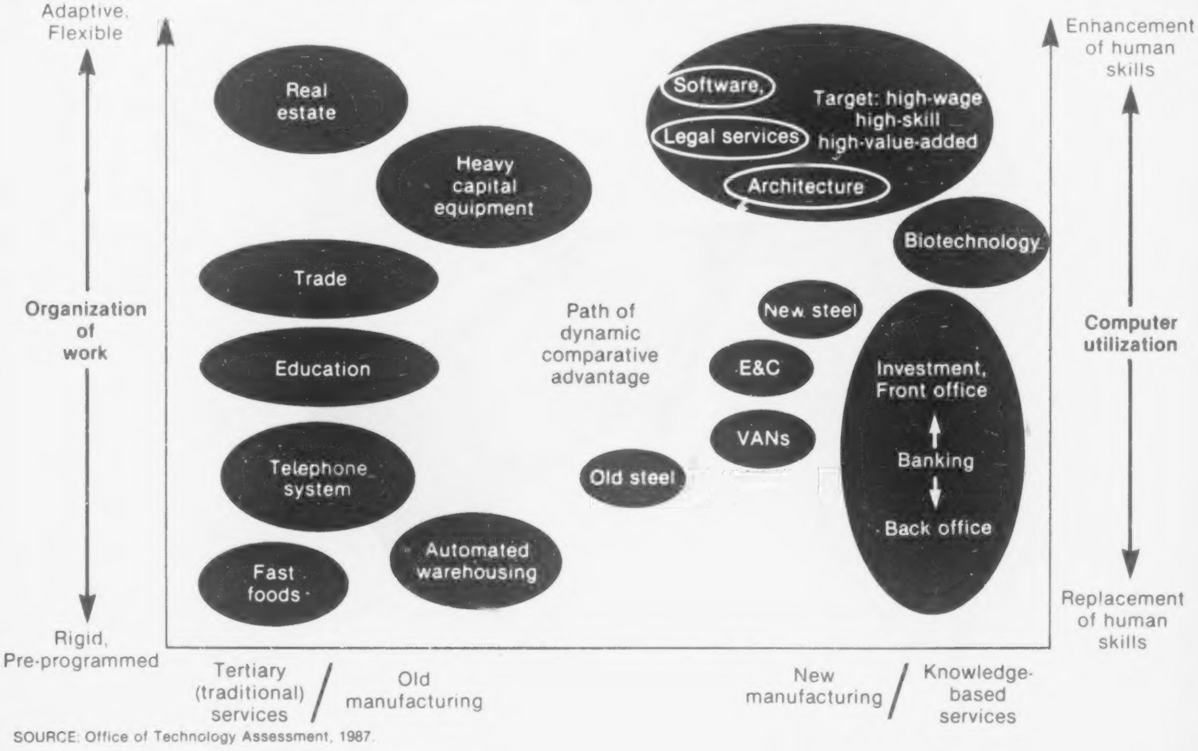
and/or its production processes, on technical expertise, know-how (whether well-codified, as in a computer program, or tacit, as in people with experience, well-honed skills, good judgment), and inputs of data and information (e.g., from process control sensors); and

- work organization, ranging from rigidly programmed or rule-based, as for telephone operators, to flexible and adaptive, as in the groups of more-or-less autonomous professionals who work in investment banks or R&D laboratories. (Note that, today, computer technologies may be indispensable at both ends of the work organization spectrum, but they are used to regulate and/or replace human abilities at the one end, to support and enhance people's skills at the other).

Figure 6 includes examples of both manufacturing and service industries ordered on such dimensions. In essence, the horizontal axis takes the distinctions summarized earlier in table 5 between tertiary and knowledge-based industries, spreads them along a continuum, and adds a similar distinction between "old" and "new" manufacturing. Information/knowledge content cannot be measured precisely, but is closely related to customized production—whether of legal services, computer software, or a batch of low-sulfur, low-phosphorous steel with high resistance to lamellar tearing. (These distinctions are examined in more detail in ch. 8, as are the work organization and computer utilization dimensions along the vertical axes.)

Moving from lower left to upper right in figure 6 corresponds roughly to the direction of change in the U.S. economy since the close of the Second World War. These changes will continue; indeed, as the figure suggests, an ongoing shift seems necessary if the United States is to remain competitive in high-skill, high-

Figure 6.—Characteristics of Firms and Industries


Adaptive, Flexible
Organization of work
Rigid, Pre-programmed
Enhancement of human skills
Computer utilization
Replacement of human skills
Real estate
Heavy capital equipment
Trade
Education
Telephone system
Fast foods
Automated warehousing
Software,
Legal services
Architecture
Target: high-wage high-skill high-value-added
Biotechnology
New steel
E&C
VANs
Old steel
Path of dynamic comparative advantage
Investment, Front office
Banking
Back office
Tertiary (traditional) services / Old manufacturing
New manufacturing / Knowledge-based services

SOURCE: Office of Technology Assessment, 1987.

wage, high-value-added industries—with the higher living standards this implies. The movement is not so much from manufacturing toward services as from one set of manufacturing and service industries to another, and from one set of internal attributes in each sector to another. The United States does not need to evolve toward a service economy. It does need to move toward a high-skill economy.

Chapter 2

Services in the World Economy

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Chapter 2

Services in the World Economy

SUMMARY

The international competitiveness of any industry depends on the ability of firms in that industry to design, develop, produce, and market their output. This is just as true for Eurobonds or a database on organic chemicals as it is for soybeans or 747s. The ability of individual firms to compete effectively depends on a broad range of factors, some of which the firm can control (the people it hires), some of which it cannot (the labor pool from which it hires them). Government policies affect competitive ability at many points: tax rates here and abroad; tariffs and other trade barriers; export assistance. Policies in the United States and elsewhere, in turn, affect corporate decisions—whether, for instance, a firm will seek international business through exports or overseas investments.

Together, the competitive ability of the firms in an industry will determine the international competitiveness of that industry. But it makes little sense to talk about the international competitiveness of an economy. Rather, the competitive rankings of the industries in the U.S. economy—relative to one another and relative to their counterparts elsewhere in the world—determine what the Nation will export and import. In turn, the goods and services that the United States exports and imports affect U.S. living standards.

Simply put, the United States exports the products of the industries in which it is most competitive: if, over time, the U.S. banking industry becomes more competitive internationally, its exports may increase while U.S. exports in, say, the computer industry may decline (or rise more slowly than they otherwise would). In this sense, industries compete with one another for export sales as well as domestically; when some industries grow more competitive, others will probably become less competitive. But services and goods also depend on one another. The more efficient and more competitive the U.S. financial services industry, the more competitive their customers in other industries can be. The same is true for any service industry that sells to business customers. And the more competitive these customers, the better the opportunities for growth by their suppliers.

Companies buy some of the inputs they need to produce their end services and goods, do the rest themselves. U.S.-based service companies have followed their customers in other industries overseas, in many cases successfully exploiting advantages that come with multinational integration—ranging from lower costs to name recognition and reputation. Today, many American manufacturing firms purchase services they once produced internally. At the same time, they may sell services alongside their goods (or through another arm of the company). As many examples illustrate, structural and technological changes, in both services and goods, within the U.S. economy and internationally, have become extraordinarily rapid over the past two decades. Within this setting—one of constant flux, and a good deal of uncertainty—companies make the decisions that cumulatively determine their competitive ability.

Governments face the same uncertainties as they make decisions that reflect their policies towards trade and industry—or, where no clear policy exists, the decisions that constitute their de facto policy. *The U.S. Government makes choices every day that affect the international competitiveness of U.S. firms and industries,* in both the services and manufacturing. Because the competitive ability of an industry depends fundamentally on what the companies in that industry do at home—and on the relative rankings of domestic industries—*Federal*

policies with domestic aims and objectives often have even greater impacts on the international competitive ability of American firms and industries than do trade and foreign economic policies.

In the services, the United States runs a positive balance of trade in almost all sectors with almost all regions of the world. OTA's estimates of services trade indicate that the official Federal Government statistics underestimate both exports and imports of services, as well as the net U.S. position on services trade. More complete and accurate data would probably show the U.S. competitive position to be even stronger.

Together with the evidence in other chapters of this report, the services data give a reasonably clear picture of the structure of U.S. comparative advantage. Diminishing competitiveness in manufacturing has meant a relative shift in U.S. strength toward knowledge-based services. Export markets for these services, however, remain modest in size. Foreign markets must often be served through foreign affiliates—with exports of capital rather than exports of products—sometimes because of foreign government trade barriers, but more commonly because service products must be produced at the point of consumption. Because of this dependence on a foreign presence, and for other reasons (including, as later chapters show, strong challenges from some foreign service industries), exports of services have not increased to compensate for the huge U.S. deficit on trade in goods. Nor is there any reason to expect that world trade in services will expand much more rapidly than trade in goods, whether or not governments agree to reduce trade barriers: taken as a whole, the available data on services trade suggest that the *direct* benefits of liberalization for U.S. interests, though real, may not be as great as sometimes assumed. At the same time, some of the countries that have opposed discussions on services in the General Agreement on Tariffs and Trade (GATT) may have more to gain than they recognize. The data themselves reveal little about indirect and strategic benefits, but much other evidence suggests that this is where the real advantages for the United States will lie, with liberalization, for example, helping U.S.-based multinationals hold on to advantages accruing through worldwide integration of business operations.

For the world economy as a whole, reductions in barriers to trade and investment in the services should lead to greater economic efficiency and more rapid growth, for two primary reasons: 1) when each country specializes in the services it is best at, all can, in principle, gain through trade; and, 2) competition can serve as a spur to domestic service industries, forcing them to become more efficient. Of course, as for trade in goods, liberalization may help the world economy as whole without aiding each and every country; some will gain more than others, and some may lose.

From its beginnings in 1947, negotiations and agreements within GATT have centered on trade in tangible goods, with limited attention to foreign investment. A 1982 Ministerial Statement initiated a process of discussion and negotiation culminating 4 years later in agreement to begin the Uruguay Round, where GATT members will discuss services for the first time. Finding an effective path to liberalization in the services poses difficult problems for negotiators. In the service industries, most of the barriers are non-tariff—often part of long-established domestic regulatory structures. Resistance to change will be high; some governments will prefer the certainty of what they have to the risks of new rules. Some nations view the Uruguay Round negotiations in North-South terms, with the United States attempting to exploit one of its few remaining advantages. To these countries, going along with U.S. demands that they open their markets may seem tantamount to giving up hope of developing a competitive service sector. At the same time, as pointed out in chapter 9, much of this resistance arose before countries thought these matters through: the fact that so many services must be produced where they are consumed means that local economies will get many of the benefits.

Beyond this, when it comes to the knowledge-based services, countries that attempt to limit imports or prevent foreign investment may end up harming their own economies by cutting off access to superior technology and expertise.

Sheltered banking and insurance industries in the developing world have been notoriously inefficient; a sound telecommunications infrastructure helps an entire economy. The Uruguay Round negotiations on services promise to be lengthy and contentious. But if successful, they could mark the beginning of a new stage in world economic integration.

COMPETING IN SERVICE INDUSTRIES

The United States grows little coffee; some Brazilians travel to the United States for a university education (which counts as the export of U.S. services to Brazil). Through trade, whether of services or goods, all nations can benefit—if the conditions are right—by specializing in the things they do best. American companies export computers and wheat, motion pictures and technology. The United States imports small cars, clothing, and reinsurance services.

What Determines Competitiveness internationally?

But if the United States is more competitive in technical licensing than in reinsurance, why? Chapter 6 explores the advantages of U.S. firms in licensing—advantages that stem quite directly from past spending on R&D. Here, as in goods-producing industries, competitiveness depends on the value for money that U.S. companies can offer compared to foreign firms. Likewise, Japanese automakers have been able to build small cars of a given design at lower cost than American manufacturers—put another way, design and develop superior cars to sell at the same price, a competitive advantage with multiple sources. Reinsurance works quite differently. Here, the United States typically runs a deficit because American insurance firms seek to spread risk internationally.

Appendix B summarizes the analytical framework for this assessment—as in previous OTA studies of competitiveness, an approach rooted in notions of comparative advantage. Just as for goods, relative costs of production will be primary determinants of competitiveness in service industries. If a South Korean steelmaker can purchase the coal, ore, labor, and other inputs for making a ton of steel for less than an American firm, and if this production cost advantage exceeds the cost of transporting a ton of steel from Korea to the United States, Korean producers will be able to sell here at lower prices than American steelmakers. If a U.S. insurance company can write an $80 million policy covering the loss of a communications satellite at a lower premium than a British company, the U.S. company is more competitive. As the second example suggests, transportation costs can be ignored for many service products. Reliable, high-speed data transmission has often reduced or eliminated transportation as a significant expense—a major force in the spread, particularly, of financial services across national boundaries. In other cases, a service firm must send people overseas in order to supply its products. Alternatively, the customer may come to the site—as when a foreign national flies to the United States for treatment at the Cleveland Clinic. Here, as for goods, reductions in travel or transportation costs spur growth in trade—with cheaper international air fares in recent years a particular stimulus to tourism. Still, there may be relatively little trade even in services where the United States has a marked competitive advantage. American physicians may be among the world's best (and most costly), but other characteristics of the industry mean they cannot provide care to large numbers of foreign patients.

For meaningful cost comparisons, goods (a bushel of soybeans) or services (an advertising campaign) must be similar in a qualitative sense. Such comparisons will be far more difficult for some products than others. It is easier to compare the characteristics of steel produced in South Korea and the United States than computers made by Unisys and Fujitsu or aircraft made by Boeing and Airbus.

Photo credit: Humana, Inc

Interpreting X-rays

Qualitative comparisons become still more difficult for services, given their intangible and time-dependent nature; purchasers rely heavily on reputation as a guide to the future. A company planning to buy a $5 million computer can run trial programs to benchmark competing machines, and ask past customers if they've been satisfied. In the end, judgment will be involved (if only in deciding what kind of benchmark tests to run, and how to interpret the results), but judgments of a different kind than for comparisons of the health care provided by two clinics or the services of two law firms. Statistics may help (mortality rates for medical operations, won-lost records for cases tried), but the next product is always in the future. Who can compare advertising services, and reduce this to cost terms? Only time reveals how good a campaign will be. Much the same is true for engineering and construction services, although the many stages of feasibility study and design specification in construction projects offer intermediate checkpoints (ch. 4). Even so, large-scale international construction shares this characteristic with open heart surgery: by the time unambiguous evidence of problems arises, it may be too late.

For almost all services, then, it is impossible to tell at the time of purchase how good the product will be. Anheuser-Busch can return a shipment of hops that does not meet standards, but the firm's managers will never know if they made a good decision in rejecting a proposed series of television commercials. Consumers have much better sources of comparative information for buying toasters or automobiles than for buying dental care (a major reason for the historical spread of licensing in the professions). For the seller of differentiated service products, this means a variety of factors besides costs come into play. Selling services, like selling some kinds of goods, may depend heavily on reputation or on established linkages between the supplier and the purchaser. Most corporations will stick with their investment banker as long as they remain satisfied (but may shop for commercial banking services based on price). Successful firms in intermediate service industries can often expand by building on their reputations, as when advertising agencies move into market research, accounting firms sell management consulting services, and banks seek to become financial supermarkets.

Many other examples illustrate some of the factors that ultimately affect trade figures and competitiveness. For Bostonians, a winter vacation may involve a choice between Florida and Mexico. A week in Miami would remain an entirely domestic transaction, a week in Cancun creates U.S. travel imports and perhaps imports of passenger fares. But the ultimate choice might be the attractions of a week in the sun versus some entirely different good or service. Purchasing a video-cassette camera and recorder instead would mean a balance of payments entry reflecting a goods import from Japan. As such examples illustrate, *services compete with one another and also with goods for both domestic and export sales.* Everything else the same, relative costs of developing, producing, and distributing service products will determine international competitiveness. But everything else is seldom the same; it is easy to compare air fares between New York and London on U.S. and British carriers, but far from easy to compare the range of services New York and London banks offer to multinational corporations.

To some extent, a company—whether an advertising agency, an airline, or a construction firm—controls its own destiny. It can hire people, invest in a computer system or in a new product line, change its management style. In other respects, the firm operates in an environment that it can influence little if at all. An American company may lobby Congress and the Administration for changes in the tax code that would help it with respect to other American firms, but it will be only one voice among many. And any one company has even less influence over interest rates or antitrust enforcement.

Table 7 lists some of the factors that affect competitiveness—in the knowledge-based services particularly—under two primary categories: those that individual firms can control, at least in part; and those that governments control or influence. Of course, some competitive factors—natural resources, labor market size—remain beyond the reach of either firms or governments.

Table 7.—Major Influences on International Competitiveness in the Service Industries

Factors subject to considerable control by individual firms:

- Strategic decisions: to develop, market, and export new service products; to invest in some overseas locations but not others; to develop a corporate data processing and communications network.
- Staffing patterns, including corporate training programs, labor-management relations, mechanisms for employee participation, management priorities, attitudes, and value structures.

Factors subject to considerable control by governments:

- Market structure—e.g., as influenced by antitrust or competition policy, price controls, public investment.
- Human resources and labor force characteristics, as affected by education and training policies, attitude toward labor unions.
- Infrastructural support—e.g., the public communications system, government funding for research and development.
- Business and economic conditions as affected by macroeconomic policies, regulations, political stability.
- Foreign economic policies, including trade policies (and trade barriers), foreign aid and assistance, support for organizations such as the General Agreement on Tariffs and Trade.

SOURCE: Office of Technology Assessment, 1987.

Appendix B includes an expanded treatment of factors affecting competitiveness, while box D discusses innovation and product development in financial services. As the box illustrates, and later chapters show in more detail and for other sectors, technology—interpreted broadly to include knowledge and expertise—is a major competitive weapon in the services.

Much of the task of analyzing competition in the services becomes a matter of determining which among the factors affecting competitiveness have the most weight in a given industry. Major questions for the U.S. Government center on the impacts of policies, positive and negative, on international competitiveness and on U.S. employment, and the leverage offered by alternative policies. As chapter 10 points out, because trade and competition in the services have been secondary concerns in the past, Federal agencies seldom consider the impacts of their actions on international competitiveness. Today, however, even routine rulemaking and policy implementation can have significant ramifications internationally. Another question follows: Given the way the U.S. policymaking system works, is it possible to do more than make a series of individual decisions constituting a de facto policy? OTA's findings for the services replicate those in earlier reports dealing with manufacturing: in order to pursue a more coherent policy, the Federal Government must develop a better understanding of the forces that affect international competition.[1] Lacking this—a grasp of what government can do and what it cannot do—attempts to develop such a policy will, more likely than not, be based on wishful thinking.

OTA's past studies of international competitiveness demonstrate that the shifting positions of U.S. industries have no single, simple cause

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[1] See ch. 10 of this report, and *International Competitiveness in Electronics* (Washington, DC: Office of Technology Assessment, November 1983), ch. 12.

Box D.—Innovation and Product Development in the Financial Services Industry

In 1980, Merrill Lynch applied for a patent on its Cash Management Account, later suing Dean Witter for patent infringement—one example among many of the institutionalization of R&D by financial services firms.[1] Major commercial and investment banks have created new product groups, much as found in manufacturing firms. Seeking to turn R&D to competitive advantage, banks search for new products that can differentiate their services in a highly competitive market. They also seek better production methods that can reduce their costs.

Interactions of the macroeconomic environment, regulations, and technology drive innovation in banking:

- *The Macroeconomic Environment*—Inflation in the 1970s made it profitable for mutual fund companies to offer money market accounts. Banks, which still faced regulatory ceilings on deposit interest rates, could not compete and lost business. Eventually, the banks were able to convince government regulators to relax interest rate ceilings on some accounts. Inflation was the first step in a process that led to a broad array of new financial products. Rapid swings in exchange rates have likewise created new demand for products that hedge or exploit currency risks.
- *Deregulation*—Today, banks have far more freedom to offer new and different products than 15 years ago. So do firms outside the industry, now permitted by regulators to offer many bank-like services.
- *Technology*—Back-office automation has lowered the costs of processing financial data. New services can be offered at attractive prices. Lower prices have increased demand for old as well as new services.

At least since the first transatlantic cable, advances in communication technologies have brought national capital markets closer together. Today, differences in rates of return are almost instantaneously arbitraged. Morgan Stanley can transmit its entire "book" of outstanding investments from London to New York at the end of the London trading day; still later, the book can be transmitted to Morgan Stanley's Tokyo offices.[2] New analytical capabilities reduce some banking activities to a set of rules (lending to individuals, foreign currency trading) that can increasingly be automated, sometimes with the aid of expert systems (see chs. 3 and 8). Program trading on stock exchanges reflects the development of new products such as stock index futures, and a new ability to quickly find arbitrage opportunities.

Table 8 lists some recent developments in financial products, focusing on those important in international banking. Chapter 3 discusses several of these in detail, while the glossary in appendix A defines the less familiar terms. Given the volatile behavior of both exchange rates and interest rates, demand has grown for *price-risk-transferring* products that tie the prices of financial assets more closely to market indicators. With the widespread perception that creditworthiness has declined generally, markets for *credit-risk transferring* instruments have expanded. *Liquidity-enhancing* products are a consequence of high interest rates, which make highly liquid investments more costly, coupled with worries about the creditworthiness of banks. *Credit-generating* innovations follow from increased

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[1] The lawsuit was eventually settled out of court.

For examples of R&D by a bank, see K.J. Freeze and R.S. Rosenbloom, "Banc One Corporation and the Home Information Revolution," Harvard Business School Case Study 9-682-091, 1982. This bank has been budgeting 3 to 5 percent of earnings for R&D for many years.

For a broader survey, see "Recent Innovations in International Banking," Bank for International Settlements, Basel, Switzerland, April 1986, p. 184-86. Box FF in ch. 9 summarizes services-related R&D spending, while ch. 3 examines competition in international banking.

[2] J. Maranoff, P. Tate, and B. Whitehouse, "Around the World in 24 Hours," *Datamation*, Jan. 15, 1987, p. 75. While this might seem a technologically simple step, it has only recently become feasible. Other large firms, including Citicorp and Merrill Lynch, do not yet have the capability to manage a global inventory of financial instruments in real time and multiple currencies.

The huge dollar amounts involved in financial communications make reliability and security critical. Some banks have established their own communications networks, others have hired experts trained in security, intelligence, and encryption away from governments.

demand for credit, especially in the United States. Many of these products are possible only because of deregulation in the United States and abroad, and practical only because of new communications and data processing capabilities.

Innovations in the payments process have also been rapid—for both small transactions (credit cards) and large (funds transfers between banks using national and international computer networks—see box G in ch. 3). Here, competitive advantage for any one bank will be limited; because payments by definition involve transactions between two or more financial institutions, new developments must be shared. Thus banks have found it in their interest to link their automatic teller machines.

Changes such as those outlined above have profoundly affected the nature of competition over the past 15 years. Cheaper, more reliable, more pervasive communications systems mean that local banks face competition from money center institutions. Restrictions on interstate banking have crumbled. Non-financial firms—including retailers like Sears and diversified corporations like General Electric (through its GEISCO subsidiary, ch. 5)—have drawn on capabilities and experience developed in internal data processing operations to compete with banks. New products and proprietary technology have given American firms like Citicorp a competitive edge in markets abroad, but internationalization of capital and financial markets has led to increased competition from foreign banks here.

Table 8.—Examples of Product Innovations in Banking

	Function			
	Price-risk-transferring	Credit-risk-transferring	Liquidity-enhancing	Credit-generating
Floating rate loans	✓			
Back-to-back loans	✓			
Securitized assets		✓	✓	
New cash management techniques			✓	
Negotiable money-market instruments			✓	
Zero coupon bonds				✓
Junk bonds				✓
Futures	✓			
Swaps	✓			✓
Forward rate agreements	✓			
Note issuance facilities	✓	✓	✓	

SOURCE: Adapted from "Recent Innovations in International Banking," Bank for International Settlements, Basel, Switzerland, April 1986, p. 172.

(such as the strength of the dollar). Nor do shifts in competitive standing have single, simple consequences. For the United States, a strong dollar during the first half of the 1980s, *combined* with ongoing structural shifts in the U.S. and world economy, led to seriously declining competitiveness in major industries. Many of these structural shifts can be traced back to the 1960s; in the steel industry, for example, worldwide overcapacity—creating strong incentives for price-cutting and subsidies—has had greater impacts on the plight of the large, integrated American firms than exchange rates. Other generalizations concerning international competitiveness, typically underappreciated, include:[2]

1. When a nation such as the United States engages in international trade, some of its industries must by definition be competitive, but some will likewise be uncompetitive. Over time, in order to export, a nation must import; if it imports, it must export. This suggests that *increasing competitiveness in some industries will nec-*

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[2] *International Competitiveness in Electronics*, op. cit., pp. 166-168.

essarily be accompanied by declining competitiveness in others.

2. If, as has been true of the United States for several decades, a nation's overall rate of productivity growth lags compared to its competitors and trading partners, the result need not be losses in competitiveness for all industries, provided exchange rates are free to adjust and trade barriers do not intervene. But if overall productivity in the United States were to increase faster than in other countries, some formerly competitive American industries might become uncompetitive. The productivity increase would make U.S. exports more attractive. Domestic customers would also choose U.S. products as substitutes for imports. In the normal course of events, the dollar would appreciate compared to other currencies. This, in turn, would make some industries—probably those with relatively low productivity growth—less competitive.
3. When industries experience relatively rising costs in world markets, and lose market share both at home and abroad, the price system may be signaling that resources should be reallocated internally. Prominent examples in the United States include shrinkage in the domestic steel industry, and in textiles and apparel. Because the services and manufacturing compete for export sales, expansion in the services will interact in complex fashion with declines in the international competitiveness of U.S. manufacturing industries.
4. Almost any policy adopted by the Federal Government may affect, directly or indirectly, the competitive standing of U.S. industries: all Federal policies that affect business and industry must be assumed to result in winners and losers. In an economy open to imports, it is not possible to simultaneously help all sectors compete internationally. *The Federal Government makes choices among industries all the time, explicitly or implicitly.*

Multinational Operations

During the postwar period, many American corporations have concluded that successful competition against other U.S. and foreign firms requires a multinational presence; when a U.S.-based company sets up manufacturing operations in a new country, American banks and accounting firms often follow. Spreading investments by multinationals over the past 35 years have led to rapid growth in international trade among affiliates. Microelectronics provides one of the more dramatic examples; up to three-quarters of U.S. imports have consisted of intra-firm shipments, primarily from subsidiaries in Asia. Overall, the interdivisional shipments of U.S.-owned firms account for about 20 percent of the nation's goods imports.[3] Most of the same motives operating in manufacturing have driven multinational integration and intra-firm trade in the services. But there is a major difference: many services cannot be supplied in a foreign market without an on-the-ground presence.

The Need for a Foreign Presence

Goods can be shipped from place to place and held in inventory; most services cannot. Of course, there are exceptions. Construction can be viewed as a service (or not); if designing a bridge or a hospital seems less ambiguously a service than carrying out the construction, the plans, drawings, and bills of materials are quite tangible—they can be stored, transmitted from place to place, and modified during building. The package of information constituting a "design" (or a computer program or an advertising campaign) has a permanent physical existence quite unlike the services provided by a trial lawyer or a banker. But regardless of such distinctions, exporting means selling to a foreign customer (the importer) a service produced by factors of production (inputs) located in the exporter's country. This may not be possible for intangible and nonstorable services. If it is possible, it may still require a physical presence in the importing country, with some of the value added there. Direct investment in a subsidiary corporation or joint venture may be essential, particularly in view of foreign government regulations. Other possibilities include branches, franchises, sales agents, and marketing or distribution affiliates.

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[3] Based on B.F. Brereton, "U.S. Multinational Companies: Operations in 1984," *Survey of Current Business*, September 1986, table 2, p. 28. Thirty percent of U.S. exports go to overseas affiliates (both figures are for 1984). Other estimates have been as high as 40 percent on the import side and 35 percent for U.S. exports—J.S. Little, "Intra-Firm Trade and U.S. Protectionism: Thoughts Based on a Small Survey," *New England Economic Review*, January-February 1986, p. 42. On microelectronics, see *International Competitiveness in Electronics*, op. cit., p. 136.

A commercial bank or an accounting firm will not get many sales in foreign countries without foreign offices. In some contrast, businesses such as reinsurance and investment banking operate in what amounts to a global market. The primary buyers and sellers not only know one another, they tend to be less parochial than smaller firms; to a multinational corporation (MNC) seeking to insure its risks worldwide, it will make little difference whether the carrier has offices in all the countries where the MNC operates.

Even tourism depends on advertising and representation in the importing country (i.e., the home country of travelers). National tourism industries staff promotional offices in major importing countries. They advertise, cultivate ties with travel agents, seek favorable publicity in the media. Similarly, airlines need reservation/information offices in the major cities and countries they serve. Hotel chains provide marketing/reservation networks for their members. For manufacturing companies, on the other hand, services like technical licensing may simply be an occasional business, and thus an exception to the need for a foreign presence. Even so, some American firms with high volumes of overseas licensing have established offices to help their licensees; RCA opened a laboratory in Japan for this purpose in 1954.

In some cases, communications technologies may reduce or eliminate the need for a foreign presence, in others not; 24-hour securities trading, with exchanges always open somewhere in the world, will probably mean stationing brokers overseas. While a trader in New York could place an order on the Tokyo exchange in the middle of the night, most transactions will probably be made by people in Tokyo who are wide awake.

Integration

Vertical integration implies sequential operations under common management. A chain of fast-food restaurants that raises its own chickens has integrated vertically. When two firms competing in the same market merge, they have integrated *horizontally*. Other forms of integration include *geographic* expansion—as when a hotel chain or financial institution enters another country. Citibank offers much the same range of services in many nations (ch. 3). A foreign branch or subsidiary gets advantages from the parent bank's expertise, international linkages, reputation, and visibility in the marketplace. Engineering and construction (E&C) firms that utilize proprietary knowledge at home and abroad have likewise integrated across technologically related markets. Diversification of a firm's product lines can lead to integration; when United Airlines merged with Westin Hotels and Hertz, it could capitalize on its existing relationships with travelers and travel agencies. Finally, a firm can expand into totally unrelated areas, as ITT did with its purchase of Sheraton.

Vertical integration especially—raising one's own chickens—can be a source of competitive advantages that accrue over both short and long time periods. Internal transactions usually carry lower costs for information and control (purchasing, negotiation and monitoring of contracts, quality assurance). These advantages hold for geographic integration as well. A firm that manages its own production chain may be able to maintain lower inventory levels as protection against supply interruptions, with savings in inventory and transportation costs particularly attractive for an MNC that can effectively coordinate production and shipping in many parts of the world. When the MNC relies on a telecommunications network to capture these benefits, the result may be intra-firm trade in data-processing services as well as in the firm's end products. Cost savings and quality improvements in day-to-day management accrue through established working relationships, similarities of attitude and outlook, and other characteristics of an established (and exported) corporate culture. Indeed, many American MNCs go to considerable lengths to transplant their cultures overseas, seeking the benefits of improved communications, shared goals and commitments, common jargon. Networks of acquaintances among employees, and mutual trust among people who must deal regularly with one another, can be of real importance to a multinational, even though precise benefits may be hard to pin down in terms of costs or other measures of competitive ability.[4]

Because companies can protect their technology more effectively, they will normally be more willing to pass on learning-by-doing knowledge to an overseas subsidiary or joint-venture partner than to an unaffiliated concern. Efficient markets seldom exist for proprietary technology, particularly technology based on tacit knowledge and experience (ch. 6). Nor can a bank or an E&C company sell or lease its know-how as easily as a hotel chain or manufacturing firm. If a company cannot readily market its experience, however, it may be able to transfer it internally—for instance, by sending employees abroad to train local people.[5] For services, where no blueprint can describe the product, integration under a common management structure makes it easier to achieve consistency and quality of output. Examples include accounting, the hotel industry, and consulting services. Through franchising arrangements which include training programs for overseas employees, Holiday Inns can exploit its know-how and reputation without the need for equity investments. Advertising campaigns that build brand recognition work to the advantage of all franchisees.

Service firms with widespread name recognition have a head start in expanding into new geographic areas or product lines; Hertz and Hilton rely heavily on reputation to get the business of harried travelers just arrived in Munich or Manila. But for name recognition to be a useful marketing tool, consumers must believe that products differ among firms. When all firms in an industry produce services that are essentially the same, competitors try to differentiate their output, seeking to build brand allegiance. Airlines do this, along with Caribbean islands. On balance, reputation and name recognition (and track record) have been advantages for American service firms operating internationally. When they have followed their U.S.-based customers abroad, their reputations have helped them sell to foreigners as well. American E&C firms like Bechtel benefited from heavy foreign direct investment (FDI) by American firms in the 1950s and 1960s. American Express grew rapidly during the years when U.S. tourists could more readily afford to travel than those from other countries.

U.S. firms continue to be leaders in global integration. American franchisors have more than 27,000 overseas outlets; by comparison, foreign franchising has been almost nonexistent in the United States.[6] But American companies have never been alone as multinationals; some large European firms (Shell, Unilever) have operated in many parts of the world for years. Since the end of the 1970s, Japanese firms have been expanding rapidly through direct in-

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[4] Consider Vernon's vision of the ultimate multinational:

> Picture an MNC with an innovating capability that has developed a powerful capacity for global scanning. Communication is virtually costless between any two points on the globe; information, once received, is digested and interpreted at little or no cost. Ignorance or uncertainty, therefore, is no longer a function of distance; markets, wherever located, have an equal opportunity to stimulate the firm to innovation and production; and factory sites, wherever located, have an equal chance to be weighed for their costs and risks.

"The Product Cycle Hypothesis in a New International Environment," *Oxford Bulletin of Economics and Statistics*, vol. 41 (November 1979), p. 261.

[5] See R.K. Shelp, J.C. Stephenson, N.S. Truitt, and B. Wasow, *Service Industries and Economic Development* (New York: Praeger, 1984). Firms can also exploit proprietary technology through management consulting contracts and turn-key plants.

[6] *Trade in Services: Exports and Foreign Revenues* (Washington, DC: Office of Technology Assessment, September 1986), p. 69.

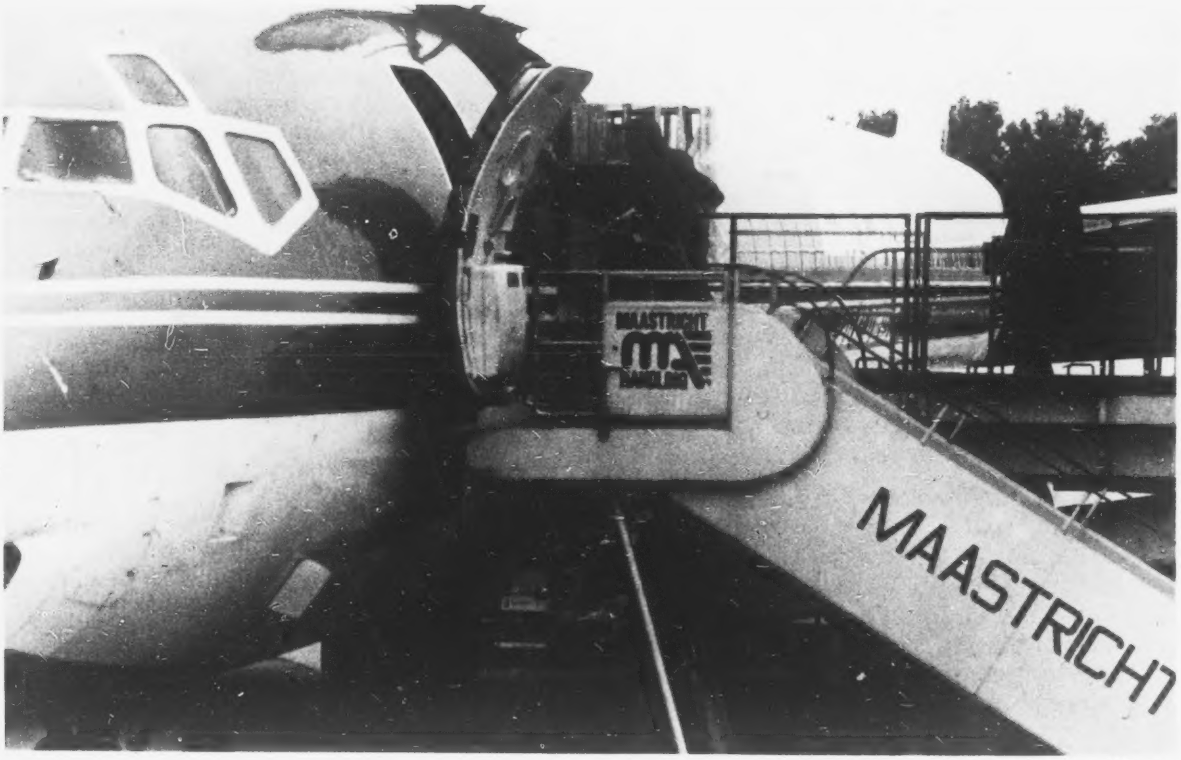

Photo credit: Emery Air Freight

International air freight

vestment, with trade friction and the threat of protection a powerful driving force. In manufacturing industries, Japanese FDI in Europe and North America has doubled since 1983.[7] With Japanese manufacturers becoming true multinationals (rather than simply exporters), Japanese service firms—banks, E&C companies, and others—have been following them overseas. Japan's trading companies are there already.

As firms based in other countries follow the example of American MNCs that began expanding abroad in earlier years, the competitive advantages U.S.-based multinationals have enjoyed through worldwide integration will probably diminish. At present, U.S.-based MNCs have an edge in managing globally integrated organizations, in part through the application of technologies such as the computer and telecommunications networks discussed in chapters 5 and 8. Maintaining this source of advantage will be vital for future U.S. competitiveness. Liberalization of trade and investment in the services will help.

Services and Goods

Goods and services compete with one another. Market forces and flexible exchange rates imply that an increase in exports of one good or service may lead to a decrease in exports of others. Sometimes, of course, success in exporting services will lead to new exports of merchandise—most obviously, when E&C contracts result in exports of capital goods.[8] When an American E&C firm designs, say, a petroleum refinery, it will ordinarily specify American-made equipment. Likewise, selling goods overseas may lead to new service exports; as the installed base of computers grows in other countries, markets for software and for data processing and information services expand. In still other cases, services may be bundled with manufactured goods—software goes with computers, maintenance and training contracts with capital equipment (commercial aircraft, power-generating equipment). These linkages magnify the importance of maintaining international competitiveness in the services or goods that lead to secondary exports.

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[7] "Japanese Direct Investment," *Japan Economic Survey*, January 1987, p. 16. Despite the rapid rise in manufacturing investments, Japan's total foreign investment position remains heavily concentrated in real estate and financial services.

Manufacturing industries, furthermore, rely heavily on services as *inputs*—engineering, sales, accounting, finance, management consulting. Companies produce some of these services internally, while buying others on the outside. Even when a firm's output consists wholly of manufactured goods, more of its employees may be performing service functions today than in the past—in support of others in the organization, or customers on the outside (ch. 7). Knowledge-intensive or high-technology manufacturing firms employ substantially higher fractions of white-collar personnel than firms in more traditional industries; production workers account for about two-thirds of U.S. employment in consumer electronics, only a little over a third in the computer industry (where many more people work in R&D or in company-owned marketing and service organizations).

Advertising and other marketing-related services have traditionally been purchased externally, along with banking and some kinds of accounting services. These patterns can change quite rapidly. As noted in the next chapter, large corporations have begun to take care of many of their own financing needs—e.g., by floating bonds and commercial paper themselves. At the same time, companies in manufacturing industries like automobiles and steel have begun purchasing more technical services on the outside. Even those with vast technological resources, like General Motors and Daimler-Benz, have contracted out engineering services—for instance, the design and development of cylinder heads. Contract design services easily shade over into contract manufacturing, particularly when volumes are low; Cosworth Engineering (a British firm) not only designed a specialty cylinder head for one of Daimler-Benz's car lines, but produces them.

Reasons for external purchases include the following:

- External specialists may be able to supply services, ranging from software maintenance to plant security, more cheaply. By selling to many customers, they can develop expertise and achieve scale economies that users cannot match within their own organizations. An outside firm may be able to provide hazardous waste disposal services more efficiently both because it has experience with available technologies and because it knows the government regulations. Airline deregulation has led to shifts in cost structures that may make it cheaper to contract out services such as refueling, baggage handling, and pilot training to specialist firms.
- Companies may turn to service firms for temporary personnel or contract production to meet peaks in demand without expanding their own work force or investing new capital (ch. 7); when the aerospace firm Grumman hired 20 free-lance software engineers on a temporary basis, it avoided both several months of recruiting and subsequent dismissals at the end of the year-long project.[9]

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[8] While quantitative data are sparse, the U.S. International Trade Commission's report on the subject includes many examples. See *The Relationship of Exports in Selected U.S. Service Industries to U.S. Merchandise Exports*, USITC Publication 1290 (Washington, DC: United States International Trade Commission, September 1982). For 1982, the 67 U.S. service industry firms responding to the Commission's voluntary survey estimated that their overseas activities generated $3.4 billion in merchandise exports (p. 4).

[9] The engineers were needed for work on a new airplane's computer system—L. Reibstein, "More Companies Use Free-Lancers, Avoid Cost, Trauma of Layoffs," *Wall Street Journal*, Apr. 18, 1986, p. 23.

- Firms may license or purchase technology to save on R&D costs (ch. 6), or hire management consultants to help with new or unusually complex problems (including international operations).

The more competitive the service industries that provide inputs to American manufacturers, the easier it is for those manufacturing companies to compete; the more competitive the manufacturers, the greater the market opportunities for suppliers of services. Both the service provider and the customer may benefit if the former follows its customers overseas. An American accounting or advertising firm that has dealt with an American client previously should be able to provide services more quickly and cheaply than a potential competitor, because its employees are already familiar with the client's business. It follows that restricting exports and investment in the services harms the competitive postures of both sets of firms.

To the extent that the process of buying services on the outside has moved the furthest in this country, American suppliers may also find new opportunities in less-developed markets overseas—e.g., in hospital management or data-processing services. In this, they would be following a common pattern in which firms offering new services or goods develop domestic markets first, then expand abroad. Management consulting, for example, is a relatively new business, one that got its start in the United States; today, most of the large American management consulting firms operate on a worldwide basis. On the other hand, as it becomes easier for local firms to procure business services (such as those listed in table 4) in their home markets, U.S.-based multinationals may lose some of the advantages they once gained from their internal knowledge and expertise.

Manufacturing companies not only supply services bundled with goods, they sell services directly. The major automobile manufacturers operate subsidiaries that provide financing. So does Sears. Some manufacturing firms own commercial banks. Many sell technology overseas. Aerospace and accounting companies have branched out into computer services (ch. 5). Outside purchase of services once produced internally can be viewed as part of a larger trend toward decentralization, smaller corporate units, and dispersed decisionmaking—a trend visible in corporate organizations in many parts of the world. Decentralization is not inconsistent with the movement toward greater global integration stressed above and in other chapters of this report; indeed, the goal of multinational integration is to couple the units of a sprawling, decentralized organization so that they can be left autonomous in some respects but not others. Integration and disintegration go on dynamically as firms seek greater efficiency and competitiveness.

MEASURING SERVICES TRADE[10]

The United States exports services when a firm located here makes a direct sale to a foreign buyer; *domestic* resources must be used to produce services sold to foreigners (including the overseas subsidiaries of American companies). When a tourist from Japan rents a car in Los Angeles, or buys a ticket at Disneyland, the transaction counts as an export of services just as for shipments of computer software. But if an overseas affiliate of an American company sells a service, exports from the United States take place only to the extent that value is added to the service here. Otherwise, the transaction simply involves domestic parties in the foreign country; any impacts on the U.S. economy, positive or negative, would then be indirect. These indirect impacts can be considerable. Data on exports and imports of services, even if accurate, do not fully reflect the significance of service exports that may, for example, lead to merchandise exports.

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[10] See *Trade in Services: Exports and Foreign Revenues*, op. cit., for a detailed treatment.

U.S. Government Balance of Payments Figures

The Bureau of Economic Analysis (BEA) in the Department of Commerce estimates U.S. imports and exports of services, and uses these in its calculations of the Nation's balance of payments. Table 9 gives BEA's categorization for invisibles (services plus investment income), representing the maximum level of detail possible with BEA's current database. BEA figures for exports and imports of services are subject to large errors and uncertainties, as discussed below.

Table 9.—Disaggregated Categories in the U.S. Invisibles Accounts

Travel
- overseas travel
- Canada and Mexico

Passenger fares

Transportation
- ocean freight
- air freight
- other freight
- air port services
- ocean port services
- other port services
- other transportation

Fees and royalties[a]
- royalties and license fees between affiliated firms
- other affiliated fees and royalties
- royalties and license fees with unaffiliated firms
- other unaffiliated fees and royalties

Private miscellaneous receipts and payments
- contractors' fees (net receipts only)
- reinsurance
- communications
- foreign governments/international organizations (receipts only)
- Canadian affiliate trade unions
- temporary resident wages
- temporary resident expenditures
- film rentals
- commissions (receipts only)
- other private miscellaneous services

Investment income
- direct investment[a]
- other private receipts and payments
- U.S. Government receipts and payments

U.S. Government transactions
- defense agencies
- other government agencies

[a] Receipts and payments by industry or industry group available.

SOURCE: *Service Transactions in the U.S. International Accounts, 1977-1983* (Washington, DC: Department of Commerce, Bureau of Economic Analysis, no date).

Figure 7 compares U.S. exports of services with investment income and trade in goods over the period 1960-85, according to the official statistics, with figure 8 the corresponding chart for imports. (In these charts, and throughout the chapter, all values are given in current dollars.) Over many years, the current account remained roughly in balance, as indicated by figure 2 (ch. 1), but the picture changed radically in the middle 1970s. Earlier in the 1970s, the balance on trade in goods had dipped into the negative region; after 1975 it plummeted. Imports of goods grew much faster than exports. During the 1970s, rapidly rising oil prices led to much of the imbalance, but the causes had shifted by the end of the decade; a strong dollar and declining U.S. competitiveness in manufactures lie behind the steeply negative trend during the first half of the 1980s.

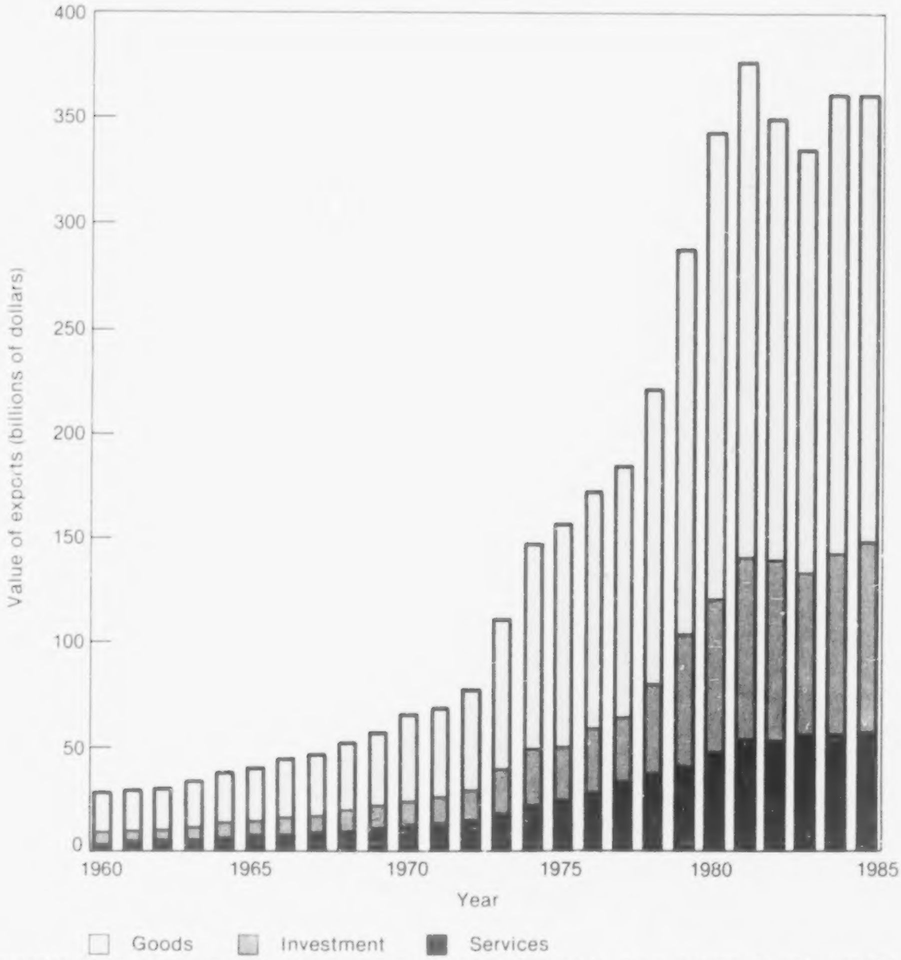
As late as 1983, surpluses on investment income and services approximately counterbalanced the goods deficit. But in 1984, the (official) surplus on services vanished, while the overall U.S. current account deficit reached the unprecedented level of $106 billion (and increased to $141 billion in 1986). Nonetheless, while it has been several years since the surplus on invisibles exceeded the deficit on goods, *invisibles in total continue to be in surplus (figure 2, ch. 1); they represent a major source of strength in the overall U.S. trade position.*

Figures 9 and 10 give the 1986 shares of total U.S. exports and imports accounted for by goods, services, and investment income. Invisibles—services plus investment flows—totaled 38 percent of U.S. exports, but only 27 percent on the import side; more accurate data for services would raise both percentages.

Exports

U.S. service exports expanded steadily over the period covered in figure 7, from $5 billion in 1960 to a BEA estimated $49 billion for 1986—an average annual increase of 9 percent. The growth rate for receipts of investment income was even higher, averaging 12 percent per year. Over this same period, exports of

Figure 7.—U.S. Exports

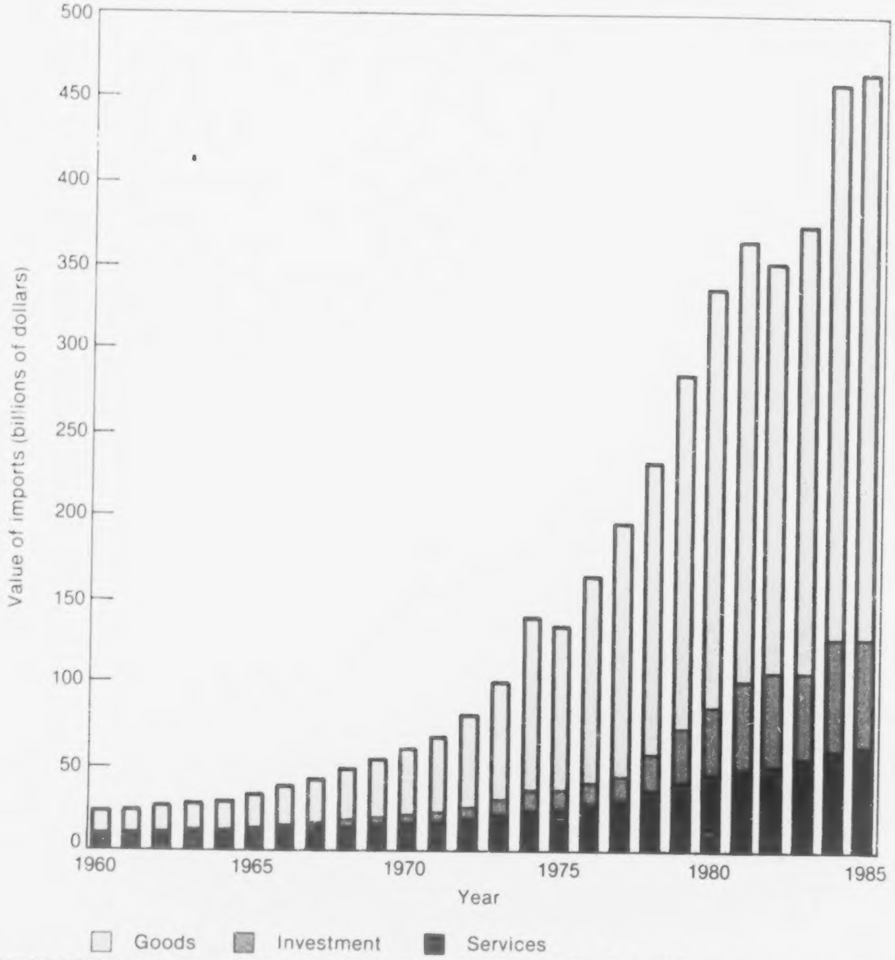


SOURCES: **1960-85:** R.C. Krueger, "U.S. International Transactions, First Quarter 1986," *Survey of Current Business*, June 1986, pp. 42-43.

goods increased at an annual rate of only 7 percent. Even so, it would take many more years of greater relative expansion in the services to change the overall proportions of goods and services in U.S. trade by very much.

Figure 11 breaks down the investment and service components of the invisibles account for the years 1977-85. BEA estimates 1985 receipts of investment income (exports) at $90 billion, 67 percent of total exports of invisibles. As the figure indicates, transportation (i.e., freight) has been the single largest export category among the services, followed by travel. (The travel category includes all expenditures by tourists and other foreign travelers except passenger fares.) The totals in both categories are considerably larger than for passenger fares, while both private miscellaneous services and royalties and fees make substantial contributions to U.S. exports. Passenger fares have grown the fastest over the past few years, followed by transportation, private miscellaneous services, travel, and royalties and fees. Note that most of the intermediate services discussed in this report fall into the miscellaneous category, with little detail available—an indication of the need for better data on services trade.

Figure 8.—U.S. Imports



SOURCES: **1960-85:** R.C. Krueger, "U.S. International Transactions, First Quarter 1986," *Survey of Current Business*, June 1986 pp. 42-43.

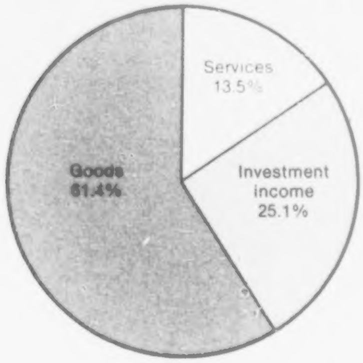
Figure 12 gives the distribution by region of U.S. service exports, 60 percent of which have gone to other advanced industrial nations (a similar percentage of U.S. service imports come from these same countries). In 1985, the European Community (EC) accounted for nearly one-quarter of U.S. service exports, followed by Canada and Japan.

Imports

Investment income is the largest item among U.S. invisibles payments—at $65 billion in 1985, coming to well over half of all private invisibles imports (figure 13)—just as among receipts. As figure 13 also shows, spending by Americans traveling overseas heads the list of service imports, followed by transportation. As for exports, passenger fares have grown the fastest. Other categories remain small by comparison.

Figure 14 shows that U.S. service imports are heavily weighted toward Latin America and Europe—much of this associated with travel and tourism. Deficits in passenger fares and travel grew steadily during the first half of the

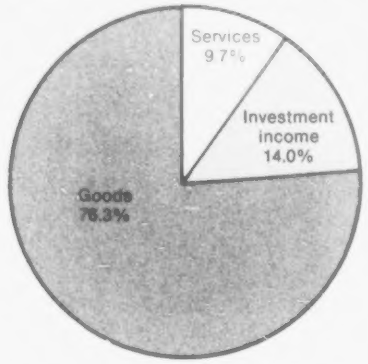
Figure 9.—Composition of U.S. Exports, 1986



Total: $361 billion
(preliminary, excluding military transfers)

SOURCE: C.L. Bach, "U.S. International Transactions, Fourth Quarter and Year 1986," *Survey of Current Business*, March 1987, p. 44.

Figure 10.—Composition of U.S. Imports, 1986



Total: $484 billion
(preliminary, excluding military transfers).

SOURCE: C.L. Bach, "U.S. International Transactions, Fourth Quarter and Year 1986," *Survey of Current Business*, March 1987, p. 44.

1980s (figure 15) in part because the strength of the dollar made overseas travel attractive to Americans.

OTA Estimates

OTA has reviewed BEA's services data elsewhere, and presented independent estimates of U.S. services trade.[11] These estimates demonstrate that current government procedures for reporting services in the balance of payments lead to large errors and uncertainties. The errors, much greater than for trade in goods, stem in part from difficulties inherent in measuring production and trade in service products. The historical origins of the services categories in the current account—as a residual for items that did not appear elsewhere—also contribute. Some service transactions are simply omitted from BEA's coverage. Other categories commingle services and investment income. Some services are misclassified. Uncertainties in assigning values, extrapolations from past surveys—some in the quite distant past—and incomplete coverage of sample surveys all contribute. Even using the best available data sources, private as well as government, the uncertainties remain large; therefore OTA has presented its estimates as ranges. (The special report cited above discusses means for improving the data on services trade, as does ch. 10 of this report.)

Export and Import Figures

Excluding banking (and services bundled with goods), OTA estimates that the U.S. balance of payments understated exports of services by $25 billion to $47 billion in 1984, with non-banking imports of services underreported by an estimated $16 billion to $33 billion. Because OTA's figures include only those service transactions that could be estimated with some reliability, they do not reflect the full impact of services on the balance of payments. Banking, in particular, has been excluded from the summary figures in this chapter because the data are so poor.

Figure 1 in chapter 1 compared the OTA and BEA results. Even basing comparisons on the *lower* bound of the range of OTA's estimates, BEA's figures show substantial underreporting —36 percent for exports, 28 percent for imports; actual underreporting by BEA is almost certainly a good deal larger. While OTA's estimates span a wide range, they do make it plain that the Nation's balance of payments surplus in services has been considerably larger than officially reported.

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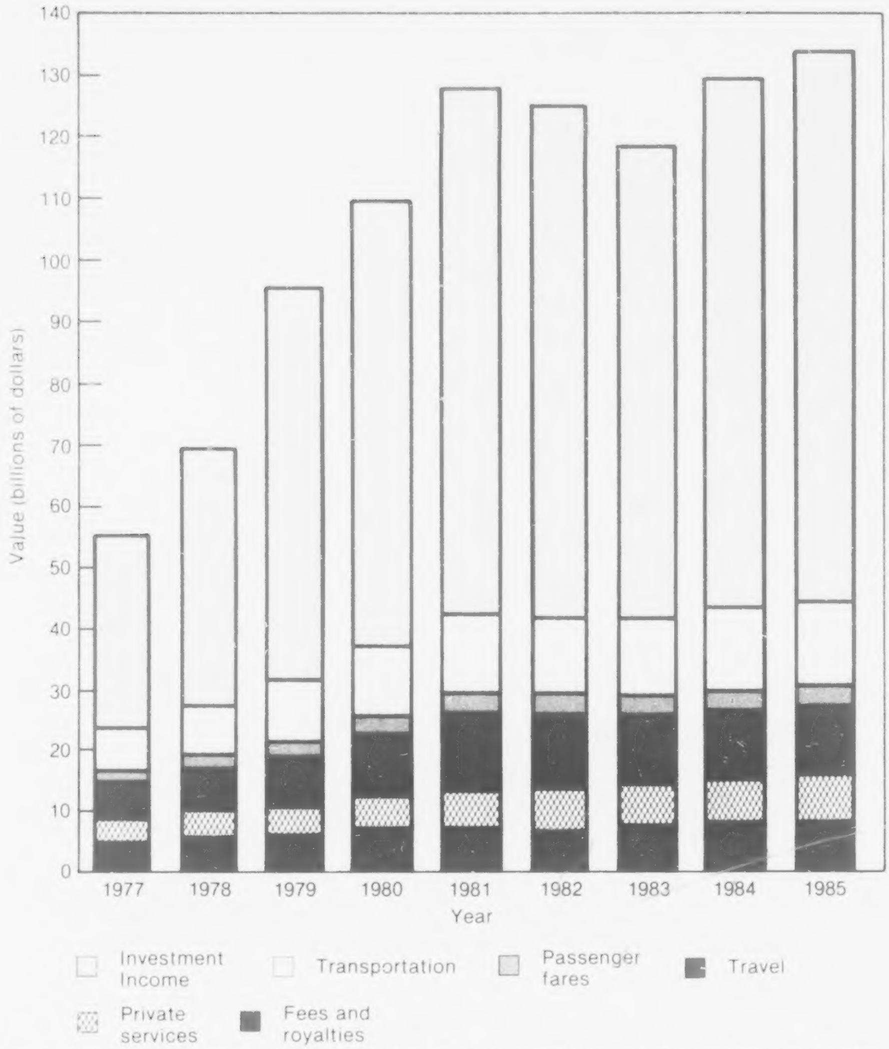
[11] For sector-by-sector estimates of 22 service industries, see *Trade in Services: Exports and Foreign Revenues*, op. cit., ch. 5. OTA's estimates in this special report do not provide geographic detail comparable to figures 12 and 14.

Figure 11.—U.S. Invisibles Receipts



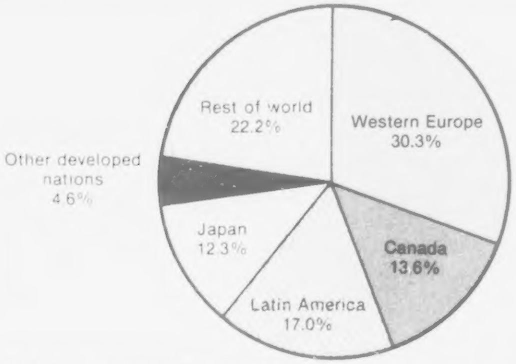
SOURCE: R.C. Krueger, "U.S. International Transactions, First Quarter 1986," *Survey of Current Business*, June 1986, pp. 36-70.

Figure 16 presents the OTA high and low estimates for service exports by industry, including a number of sectors for which no corresponding BEA figures exist. While confirming the importance of transportation and travel, the OTA special report shows many other industries to be considerably more significant as exporters than the official figures suggest. Insurance and investment banking/brokerage, for example—both largely omitted from BEA's coverage—emerge as comparable to or larger than technical licensing, and considerably greater export earners than, say, telecommunications.

Sales by Foreign Affiliates

Services provided through overseas subsidiaries or affiliates do not count in the balance of payments unless value has been added by

Figure 12.—U.S. Service Exports by Region, 1985



NOTE: Excludes investment income and government transactions. Rest of world also includes the unallocated portion of total service exports and imports, most of it flag-of-convenience shipping.

SOURCE: R.C. Krueger, "U.S. International Transactions, First Quarter 1986," *Survey of Current Business*, June 1986, pp. 36-70.

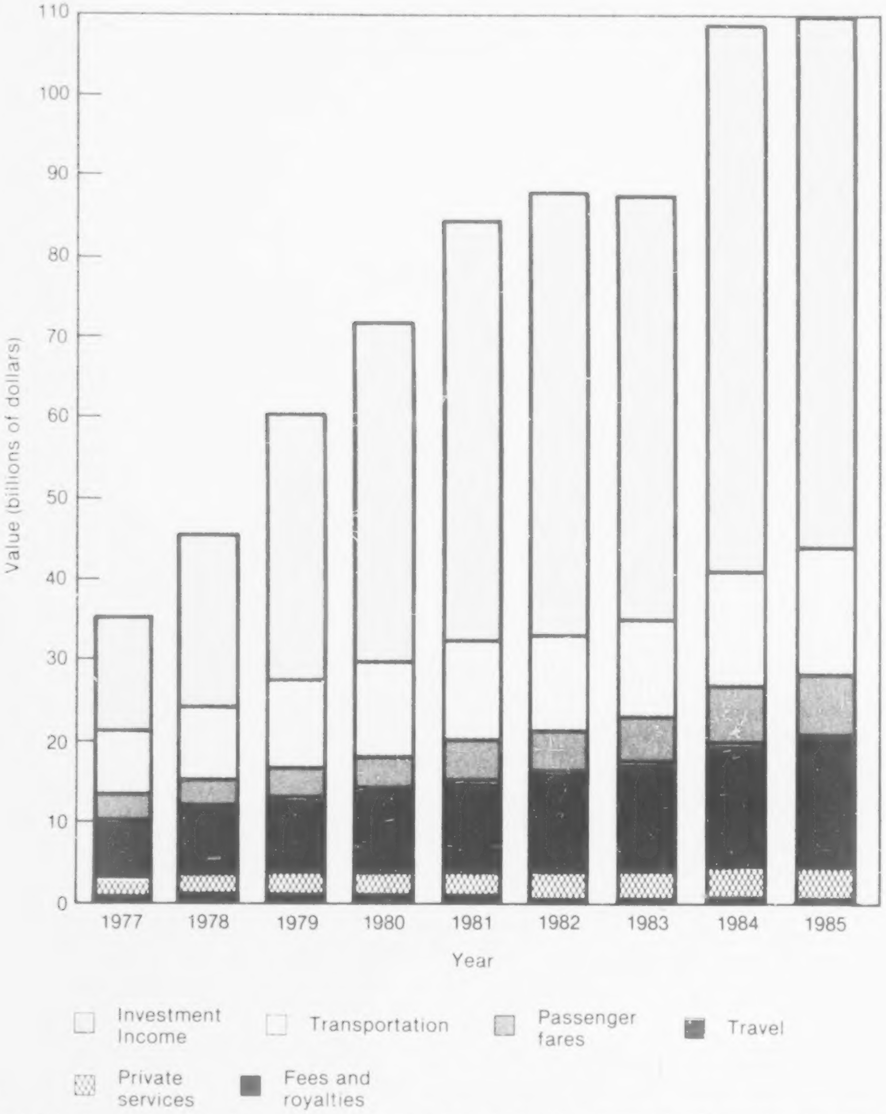
residents of the United States. In services as in manufacturing, foreign affiliates may purchase most of their inputs, including labor, on the local market. Nonetheless, as pointed out above, integration across national boundaries can be a significant source of competitive strength for American firms. Thus, measures of foreign activity broader than direct exports have a place in any assessment of the international competitiveness of U.S. service industries. The measure adopted by OTA in its special report—foreign revenues—consists of direct services trade (exports and imports) *plus* sales through affiliates (less any intra-firm trade that would otherwise be double-counted). The primary drawback of this measure lies in the broad definition of foreign affiliates used by the U.S. Government—10 percent or more ownership interest. In the normal course of events, the control of American firms over minority-owned affiliates will be limited, and these affiliates will not have a great deal to do with U.S. economic interests. Note that affiliate sales will be zero, by definition, for services like travel.

Figure 17 compares OTA estimates for exports and for affiliate sales by industry, based on the mid-points of estimated ranges. A large percentage difference between direct exports and foreign revenues warns that a focus on either of these in isolation could be misleading. In the past, given the spotty data on trade in services, confusion between exports and foreign revenues has been common, far more so than in goods-producing industries. Sometimes this confusion has extended to policy discussions. Foreign revenues in retailing, for example, consist almost entirely of sales by U.S. affiliates located abroad. Trade in retailing services is very small; when U.S.-owned retailers abroad sell goods originating in the United States, these are counted as merchandise exports. Foreign revenues in retailing—more than $25 billion in 1983 (figure 17)—have little to do with U.S. competitiveness.

Foreign service revenues of U.S. firms in 1983, the latest year for which data are available, totaled $152 billion to $169 billion, compared with direct exports of $61 billion to $75 billion. Total foreign revenues in commercial banking, for which no direct export figures are available, came to about $9 billion. (OTA estimates place service revenues of foreign firms operating in the United States at $113 billion to $131 billion in 1983, with imports accounting for $44 billion to $56 billion of this.) As figure 17 shows, much U.S. international activity in the services, whether measured by exports or the more inclusive foreign revenue figures, comes in traditional or tertiary services (table 6). Notable examples include transportation and travel. Knowledge-based services—e.g., accounting, legal services, and information services—remain small by comparison.

Any and all measures of services trade continue to be subject to substantial errors and uncertainties—as figure 1 showed. Current BEA practice leads to serious underestimates of the value of trade in services. OTA has estimated the impact of services on the U.S. balance of payments only for the years 1982-84; more than anything else, the results should be taken as evidence of the deficiencies of the existing database (and as an indication of the need to improve it). *The data on services trade are poorest for precisely those industries—the knowledge-based services—where the United States should have the greatest dynamic comparative advan-*

Figure 13.—U.S. Invisibles Payments



SOURCE: R.C. Krueger, "U.S. International Transactions, First Quarter 1986," *Survey of Current Business*, June 1986, pp. 36–70.

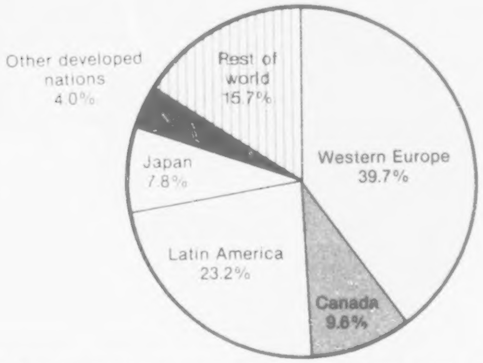
tage, and where the greatest strategic benefits for other American industries lie.

World Trade in Services

Total world services trade—the sum of all countries' exports or imports—grew at an annual rate averaging 6 percent during the period 1978-84, although, at $360 billion in 1984, still below the 1981 peak (figure 18).[12] Investment income has grown even faster, along with trade in goods—the latter at a bit over 10 percent annually during the 1978-84 period. World exports of services (excluding investment income) have remained a little less than one-fifth of world merchandise exports—a proportion unlikely to change much over the rest of the century. The "other services" category in figure 19, accounting for about 40 percent of world service exports, includes such diverse items as construction, insurance, telecommunications, and technical licensing.

Together, the United States and the other members of the Organization for Economic Cooperation and Development (OECD) account for nearly three-quarters of world service exports (figure 18). Since 1978, the share of total service exports originating in the advanced industrial nations has fallen slightly—from 81 percent to 76 percent in 1984—but the U.S. share has gone up from 10 to 11½ percent. Asian nations other than Japan (an OECD member), and

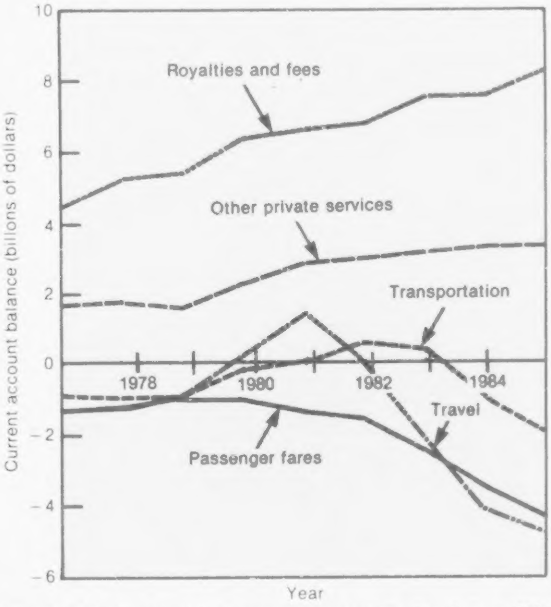
Figure 14.—U.S. Service Imports by Region, 1985



NOTE: Excludes investment income and government transactions. Rest of world also includes the unallocated portion of total service exports and imports, most of it flag-of-convenience shipping.

SOURCE: R.C. Krueger, "U.S. International Transactions, First Quarter 1986," *Survey of Current Business*, June 1986, pp. 36-70.

Figure 15.—U.S. Service Trade Balance



SOURCE: R.C. Krueger, "U.S. International Transactions, First Quarter 1986," *Survey of Current Business*, June 1986, pp. 36-70.

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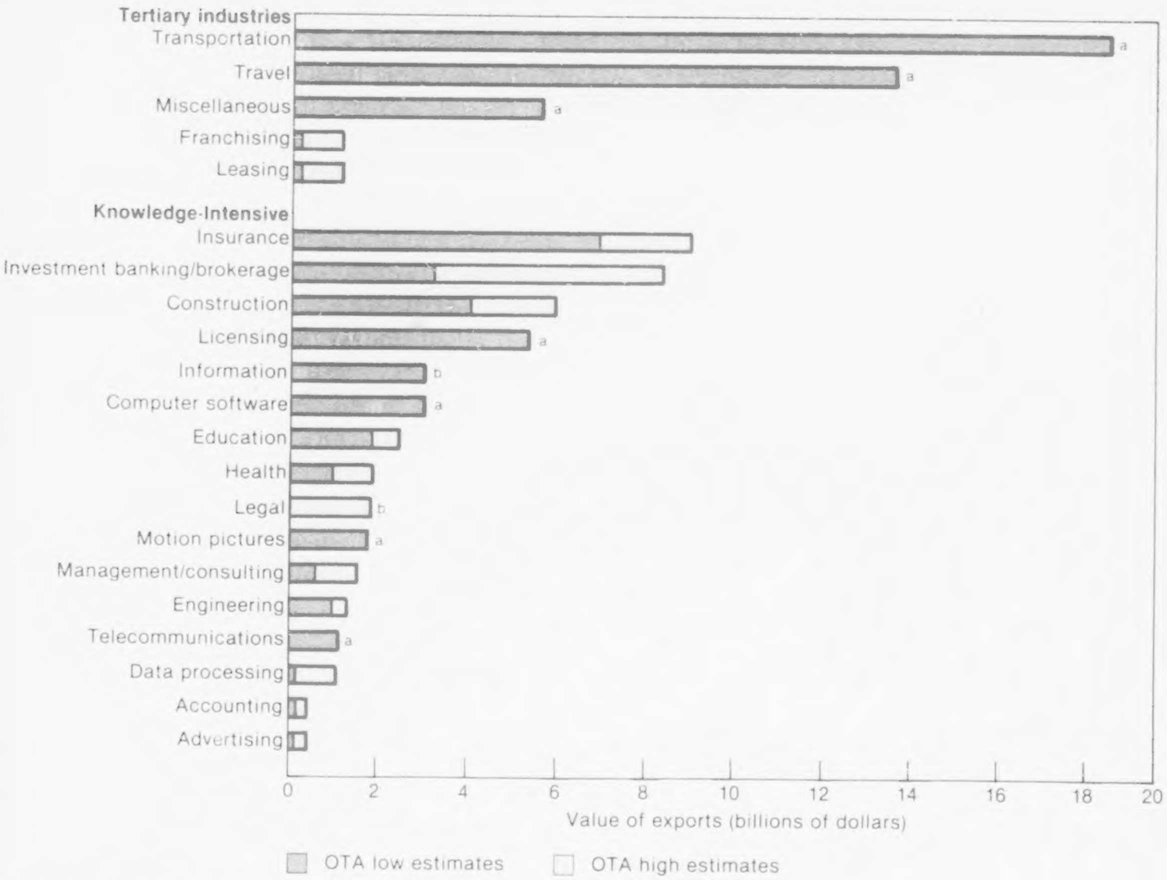
[12] When expressed in U.S. dollars, world exports of goods have also dropped since 1981, but these declines are, in essence, artifacts caused by the strength of the dollar. When expressed, say, in SDRs (Special Drawing Rights), totals for both services and goods have continued to rise, although not at the rates of the late 1970s.

Worldwide trade data come from the International Monetary Fund, which relies on figures supplied by individual countries. The quality of the data, and the basis for the services trade figures reported, differ considerably among countries; as for the United States, most of the services data are probably quite poor. (Also see the footnote to table 10, p. 69.)

Figure 16.—OTA Estimates of U.S. Service Exports by Industry, 1984



[a] High and low estimate identical

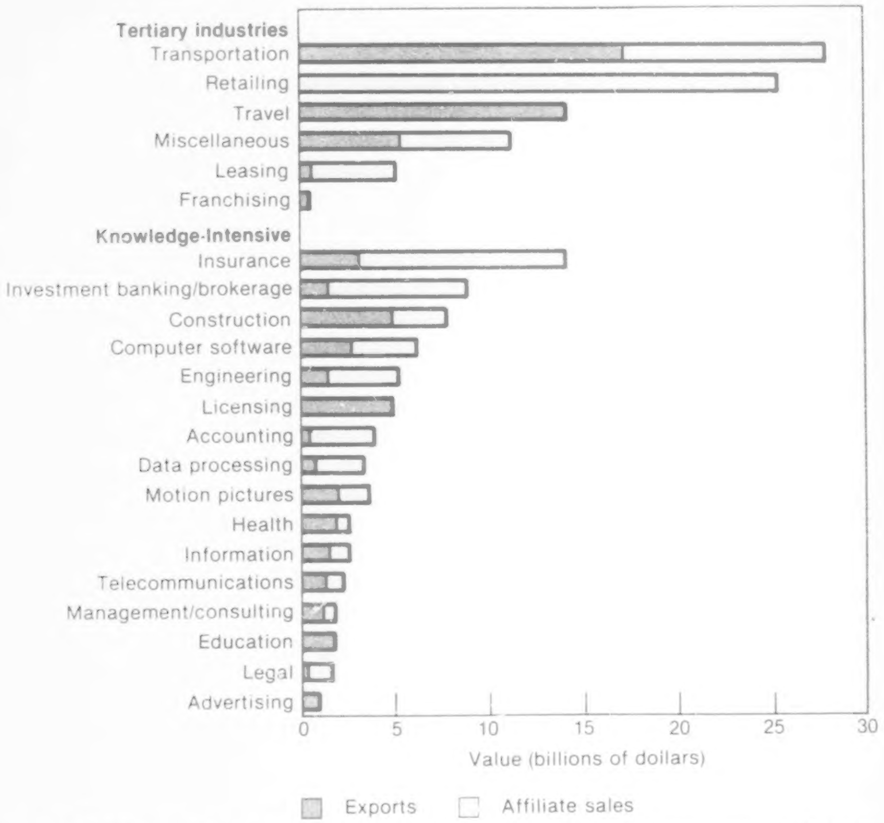
[b] Low estimate equals zero

SOURCE: *Trade in Services: Exports and Foreign Revenues* (Washington, DC: Office of Technology Assessment, September 1986), p. 38.

to a lesser extent the Middle East, also increased their shares of service exports over the 1977-84 period.

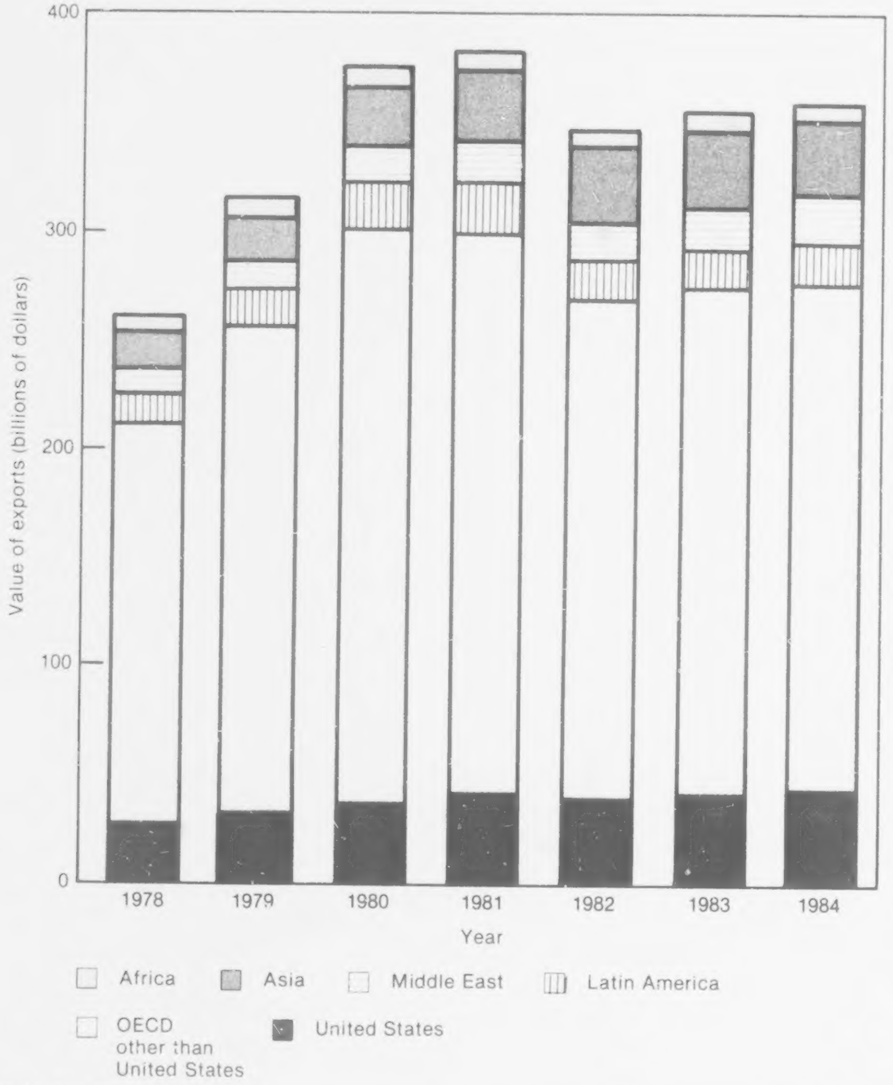
Much the same picture emerges from examination of the performance of individual countries. Although rankings vary from year to year, the United States has remained at or near the top—leading all service exporters in 1984 (table 10), the latest year for which data are available. (Note that the United States heads the list even though the rankings depend on the official BEA figures; while more accurate values for U.S. exports and imports would be much larger, the figures for other nations are probably understated too.) OECD nations fill the top 10 export positions in table 10, and 15 of the top 20. Among importers, the 6 largest—and 16 of the top 20—come from the roster of OECD members. Trade in services, then, occurs mainly among the developed economies, but just as for trade in goods, newly industrializing countries—Singapore, South Korea—are becoming more prominent. India and Brazil, however, the most vocal opponents of liberalizing services trade, appear far down on both lists.

Figure 17.—Foreign Revenues of U.S. Firms by Service Industry, 1983 (OTA mid-range estimates)



SOURCE: *Trade in Services: Exports and Foreign Revenues* (Washington, DC: Office of Technology Assessment, September 1986), p. 41.

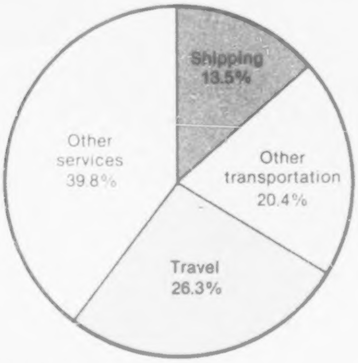
Figure 18.—World Service Exports



NOTE: Excludes investment income.

SOURCE: *Yearbook of Balance of Payments Statistics*, Part 2 (Washington, DC: International Monetary Fund, 1985), pp. 42-59.

Figure 19.—World Service Exports by Type, 1984



NOTE: Excludes investment income.

SOURCE: *Yearbook of Balance of Payments Statistics*, Part 2 (Washington, DC: International Monetary Fund, 1986), pp. 42-59.

Table 10.—Leading Exporters and Importers of Services, 1984

	Value of exports (billions of dollars)		Value of imports (billions of dollars)
United States	$41.4	United States	$41.5
France	35.5	Federal Republic of Germany	40.1
Federal Republic of Germany	27.0	Japan	35.0
United Kingdom	26.2	France	27.1
Italy	21.3	United Kingdom	20.7
Japan	20.9	Italy	15.2
Netherlands	14.4	Saudi Arabia	14.4
Spain	12.6	Netherlands	13.9
Belgium/Luxembourg	11.3	Canada	11.4
10. Canada	8.0	10. Belgium/Luxembourg	10.2
Singapore	7.7	Norway	7.0
Austria	7.7	Australia	6.7
Switzerland	7.6	Sweden	6.6
Norway	7.1	Switzerland	6.5
Sweden	6.4	Taiwan	5.2
Egypt	6.4	Mexico	5.0
Mexico	6.2	Spain	4.8
South Korea	6.1	Austria	4.7
Denmark	5.1	Denmark	4.4
20. Saudi Arabia	4.3	20. Malaysia	4.3
Australia	3.7	India	4.1
Yugoslavia	3.3	South Africa	4.0
India	3.1	South Korea	4.0
Israel	3.0	Singapore	3.9
Greece	2.8	Israel	3.4
Taiwan	2.7	Brazil	3.3
South Africa	2.5	Kuwait	3.1
Finland	2.4	Yugoslavia	2.8
30. Malaysia	2.0	30. Venezuela	2.6
Philippines	2.0	Finland	2.6
Thailand	1.9	Egypt	2.1
Brazil	1.8	Thailand	1.9
Panama	1.1	Greece	1.2
Venezuela	0.8	Philippines	1.1
Subtotal	$316.3 (88%)	Subtotal	$324.8 (84%)
Rest of world	$ 43.3 (12%)	Rest of world	$ 62.9 (16%)
TOTAL[a]	$359.6 (100%)	TOTAL[a]	$387.7 (100%)

[a] Statistical discrepencies in aggregated world trade statistics, such as here between total imports and exports of services, tend to be relatively large, reflecting errors and omissions in the data reported by individual countries.

SOURCE: *World Invisible Trade* (London: British Invisible Exports Council, July 1986), pp. 14-15. Based on data compiled by the International Monetary Fund.

WHAT CAN BE GAINED THROUGH LIBERALIZATION?

The U.S. Position Relative to Other Nations

What do the trade data summarized above imply for probable negotiating positions and possible outcomes during the Uruguay Round? While the OECD nations account for most of the world's exports and imports of services, not all these countries show surpluses. Japan, for one, had a $14 billion deficit in 1984. West Germany's deficit was almost as large. Both nations have been running large surpluses on trade in goods, suggesting a comparative advantage over services.

How about the United States? Does this country currently have an underlying comparative advantage in services? The question cannot be answered with any precision, especially at present. Effects on trade of the Federal deficit, rapid shifts in the strength of the dollar, and continuing inflows of foreign capital have created a situation without real precedent. But the data as a whole—and the OTA estimates much more than BEA's figures—suggest that American firms remain generally competitive in services. OTA's estimates show continuing surpluses in most of 22 service industries independently examined.[13] That surpluses continue to be recorded during a period of massive deficits in goods trade points, at the least, to considerable underlying strength in services, and suggests an ongoing comparative advantage in most sectors.

Does this mean that further opening of international markets for services will bring big dividends for U.S. service industries, and help the Nation's trade balance? Or does it mean that American industries are doing so well already that reductions in barriers to trade and investment would make little difference? The paragraphs that follow examine such questions on several levels.

Who Will Benefit?

Along with countries like Japan and West Germany, many developing nations have deficits that are uncomfortably large compared with their overall volume of services trade and net balance of payments position. Brazil's 1984 deficit on services trade came to $1.5 billion (table 10), while the country had a surplus of something over $13 billion on trade in goods, together with net payments on direct and indirect investment of $9 billion, reflecting past borrowing.[14] Should it be a surprise that Brazil has been a leading opponent of GATT negotiations on services? From Brazil's perspective, liberalization could be quite damaging if it led to a greater deficit in services; after all, the country needs to maintain a surplus on goods and services in total in order to meet its debt repayment obligations. Indeed, it is not obvious that opening Brazil's services markets would be in U.S. interests. Brazil owes much of its debt to American financial institutions; a greater Brazilian deficit in services trade, leading to a worsening overall trade position, could make the repayment of these loans even more problematical.

Furthermore, the aggregate figures in table 10 conceal differences that often reduce still further the enthusiasm of developing countries for negotiations. Latin America does well in net tourism receipts, where liberalization will have little effect—tourism being relatively free of restrictions. Conversely, the United States runs surpluses in those sectors slated to be subjects of discussion during the Uruguay Round: financial services of all kinds; information-related products; licensing and other business and professional services.

But OTA's estimates also indicate that intermediate and business services account for a relatively small fraction of trade. No geographic breakdowns exist for trade in knowledge-based services as a class. Nonetheless, it seems likely that much of this trade takes place among OECD countries—and probably among affiliates. (The data show this to be the case for the United States, and it is probably true for other OECD nations as well.) Where detailed information is available—as for technical licensing (see ch. 6)—the pattern is clear: intra-firm transactions within the OECD nations predominate. Two quite different conclusions follow:

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[13] At the same time, the data on trade in services are so poor, the uncertainties so large, that it cannot even be demonstrated conclusively that the United States has a net surplus on services trade. See *Trade in Services: Exports and Foreign Revenues*, op. cit., p. 38.

[14] *World Invisible Trade*, (London: British Invisible Exports Council, 1986), pp. 14-16; *Balance of Payments Statistics: Yearbook, Part 1* (Washington, DC: International Monetary Fund, 1985), pp. 84-85.

1. Foreign investment may benefit recipients, particularly developing countries, through transfers of know-how and technology without doing serious damage to their balance of payments positions because direct trade in these services will remain small.
2. Liberalization will not make for much of a difference, directly, in the overall U.S. trade balance. Unless reductions in barriers lead to unexpectedly rapid expansion of total world services trade, U.S. firms will continue to exploit their competitive strength in the knowledge-based services primarily through foreign investment and transactions with affiliates. Exports to affiliates will continue to be concentrated within the OECD. These exports will probably grow at about the same rate as in the past, because—granting exceptions such as insurance—OECD nations have seldom imposed severe restrictions on trade in knowledge-based services.

A further implication follows: although an increase of a few billion dollars in the U.S. surplus on services would certainly be helpful, the argument that liberalization of trade and investment in the services will work in the interests of the United States rests primarily on the indirect and strategic benefits, rather than on short- or medium-term improvement in the U.S. balance of payments position.

Over the past few years, as the stage has been set for the Uruguay Round, the positions taken by both the United States and the developing countries generally mirror the structure of comparative advantage as suggested by the data summarized above. The available statistics imply that developing countries have not been major factors in international services trade—and will not become so in the near to medium-term future. Although some depend heavily on industries like travel and tourism, to the extent that typical developing nations trade in services at all, they tend to have deficits. Few seem to have thought through the implications of opening their markets to foreign service firms. They commonly take the view that the risks of wider deficits outweigh possible benefits from greater imports of services embodying advanced technology—or from foreign investment that would bring them knowledge and expertise (see box E—ch. 9 explores these positions, and the motives underlying them, in more detail). *The developing world seems to have overemphasized narrow balance of payments considerations, while minimizing the possible gains from increased trade in services.* But the available data also suggest that *the United States may have exaggerated the benefits of liberalization*, at least the direct gains.

Sectoral Questions

At the sectoral level, the concerns become more specific: Are there service industries where international expansion by U.S.-based firms has been slowed, or competitiveness dampened, because of foreign government trade barriers? Are these conditions subject to change through initiatives of the U.S. Government? Most important, are there *particular* service industries where liberalization could bring especially large gains for the United States, gains that might escape the generalizations above? Indeed, there are two—computer software and telecommunications—as outlined below and discussed in more detail in later chapters.

The computer industry can serve as a reference point. American firms have led the world in computer hardware and software. More specifically, they have led the world in *applications* of computer systems. In sectors ranging from agriculture to banking, computer applications have enhanced U.S. competitiveness. Software —treated as a service in this report—embodies these applications, helping American firms cut

Box E.—Benefits From Liberalization

There is more to the argument for trade liberalization than gains from specialization (as predicted by theories of comparative advantage). When a country opens its markets to imports and foreign investment, domestic companies forced to confront new competition may take steps to improve their own efficiency—steps that can constitute a two-edge sword. Under the spur of Japanese competition, American automobile manufacturers redesigned their product lines and improved their manufacturing methods. They also cut their overhead by firing white-collar workers as well as production employees, and moved some production to foreign countries. In many U.S. manufacturing industries, rising import competition over a period of years has dampened wage increases in unionized industries and led to givebacks and two-tier wage systems—to some observers, evidence of earlier distortions in the form of union-induced wage premiums. As many such examples show, when a company reorganizes to meet new competition, its employees often bear heavy adjustment costs. But reorganization may be essential for survival.

Sheltered industries often lag in introducing new products. One of the primary arguments for deregulation in telecommunications, nationally and internationally, has been that regulation slows the adoption of new technologies. As the United States has deregulated financial services, Britain has been forced to follow suit (ch. 3). With easier entry for foreign banks, some British institutions may be unable to meet the new competition. At the same time, Britain's insurance companies have been pressing for admittance to the West German market, in part because they believe that government protection in Germany has bred inefficiencies there that they can exploit.*

Developing economies where service industries have been sheltered from outside competition should get significant benefits through greater efficiency.** While some governments have learned to steer economic growth and development with at least modest effectiveness, other countries—trying to accomplish the same thing—do more harm than good. Trade protection has been one of the standard tools in such efforts, but even among more traditional services, protection can be directly counterproductive—a developing country that restricts landing rights to support a national airline stands to hurt its tourism industry. And, while reducing barriers to services trade will help some countries more than others, the benefits in terms of world economic growth and efficiency improvements should be greater than for lowering barriers to trade in goods. Why? Most fundamentally, because international transactions in services are more likely to involve the transfer of technological knowledge, in all its dimensions. In the services, non-tariff barriers (NTBs) can easily and invisibly slow the diffusion of knowledge and learning that lead to increases in productivity and efficiency through organizational learning and a better-trained work force. MNCs contribute to global efficiency in large part through such dynamic effects: aiding in the spread of know-how, both product-specific (judging risks for loans to developing countries) and technology-specific (computerized systems for accounts receivable). Because services-related technologies must be brought to the location of production, they add directly to the storehouse of knowledge in countries lacking home-grown technical expertise. Moreover, exchanges of patents, copyrights, and other forms of proprietary technology often entail direct transfers of tacit know-how by people with experience that cannot be put down in words (how to debug a computer program, when a bank should risk a loan that does not meet its formal criteria). While the gains cannot be measured directly, trade and investment in services clearly helps economies that need such knowledge, including managerial skills, in order to develop and expand. As a result, the total gain to the world economy from international exchanges of services, per dollar of transaction, probably exceeds that from international exchanges of goods.

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*J. Carr and C. Taylor, "Brussels Puts Four Member States in Dock: An EEC Trade in Services Case is Coming Up for Close Scrutiny Today," *Financial Times*, Nov. 6, 1985, p. 8; W. Dawkins, "Court Judgement Opens Door to Lucrative European Market," *Financial Times*, Dec. 5, 1986, p. 2.

**A.F. Ewing, "Why Freer Trade in Services Is In the Interest of Developing Countries," *Journal of World Trade Law*, vol. 18 (March/April 1985), p. 147.

Beyond specialization and competition, is it possible that lower barriers to services trade could help in a third way—by easing adjustments to dislocations or disturbances originating elsewhere in the economy? Economic growth and new competition brings change, often wrenching. Companies merge, go out of business, enter different markets; new firms create new jobs. Industrial sectors prosper or decline, cities and regions follow. People who lose jobs in the steel industry may (or may not) find work in the services. The processes—normal and unavoidable—bring pain to some, prosperity to others. If the services have characteristics that make them unusually good buffers, that would add extra force to the argument for liberalization. But are the services in any sense special in their ability to cushion adjustment? Appendix 2A examines this question, finding that the answer is no. Thus liberalization of services trade has no added claim on this basis.

costs, raise productivity, and pursue new business strategies. In a very real sense, software provides the brains of the system. *International competitiveness in the computer software industry is vital for U.S. economic interests. So, by similar reasoning, is competitiveness in telecommunications* (in part because the worldwide telecommunications infrastructure is rapidly becoming a network of computers).

Of course, when U.S.-based companies sell software abroad, they help the foreign firms that use this software compete more effectively. But this is also true when American manufacturing companies transfer technology through licensing agreements, or when E&C firms undertake projects overseas. In fact, system-wide applications of digital data processing and communications technologies should greatly enhance *global* economic efficiency.

For different reasons, *the financial services industry will also remain critical for U.S. interests* (and those of other countries). Companies look to financial markets for the capital they need to grow. Governments rely on the financial sector to implement macroeconomic policy. All countries have an interest in efficient capital markets. All countries have an interest in world financial stability. Liberalization by itself—particularly in the sense of deregulation—would not necessarily enhance stability, but the analysis in the next chapter stresses the need for negotiations aimed at harmonizing regulatory and supervisory practices internationally.

Trade Barriers in the Services

Given a fluid competitive environment for U.S. firms, affected by forces as different as the strength or weakness of the dollar today and the fruits of R&D investments made 20 years ago (for instance, research in artificial intelligence, sponsored for many years by the U.S. Department of Defense and just now finding its way into the civilian economy), a primary question for trade negotiators becomes: In terms of overall impacts and significance—and in terms of effects on the U.S. economy—how important are barriers to trade and investment in services compared to goods? In other words, given an international trade regime that seems to be slowly deteriorating even in its ability to maintain reasonably open trade in goods, does it make sense to place a high priority on services in the Uruguay Round, particularly if this may mean slower progress elsewhere?

The starting point is to acknowledge that, without much question, freer trade in services will work to the benefit of the United States; the gains may not be that large or that immediate, but foreign government restrictions handicap any American industry with an underlying comparative advantage. At the same time, for reasons discussed in box E, countries that restrict trade in knowledge-based services risk depriving their own economies. But it will not be easy to reach meaningful agreements on services trade.

Today, as discussed in chapter 9, barriers to international trade and investment are typically

Photo credit: Port Authority of New York and New Jersey

Container ships passing under the Verrazano Narrows bridge.

higher for services than for goods. Protection remains the norm in agriculture, but seven previous rounds of multilateral trade negotiations have left tariffs on manufactures at low levels. Of course, governments bent on protecting goods-producing industries have many tools for doing so, and NTBs such as quotas have become widespread as tariffs have fallen. Nontariff barriers—whether explicit (quotas on imports of Japanese machine tools) or implicit (the difficulties faced by foreign firms seeking to buy a Japanese company have been called NTBs)—create new problems for trade negotiators and for international bodies such as GATT.

With few exceptions, *all* barriers to trade in services are non-tariff in nature. But NTBs in the services differ fundamentally from those affecting goods. While governments can close their borders to imports of goods, rely on uncooperative customs inspectors to harass importers, or otherwise restrict entry, services—except for those embodied in a tangible object (motion picture film, magnetic disks or tape)—do not pass through a port of entry. Given the need for a foreign presence to supply services, governments limit the operations of firms from abroad through controls on inward investment or discriminatory regulations. The regulations need have no obvious protective intent: typically, governments supervise industries like banking and insurance to protect consumers and ensure stability. Some countries have sought to control international telecommunications traffic in the name of safeguarding personal privacy—steps that could, at the same time, raise prices or hinder the operations of foreign-based MNCs. In many countries, service industries function as government monopolies, with legal restrictions on entry by any firm, foreign or domestic. Public ownership exists in manufacturing as well, but a list of service industries where it has been common—banking, telecommunications, airlines, ocean shipping, railroads, health care facilities, education, radio and television—suggests the dimensions of the problem. (Still other industries are organized as private near-monopolies, like insurance in Japan and South Korea.)

Barriers in the services, then, range from outright prohibitions on trade (quotas set at zero) or investment, to subtle discrimination against foreign-owned firms. Whenever regulations with a nominally domestic thrust have been tailored to make life difficult for foreign-owned firms, they function as NTBs.

What, then, is to be considered "fair" and what "unfair" in the services? The problems posed by NTBs affecting trade in goods have proven difficult enough. Given the intangible nature of service products, NTBs, in a very real sense, will remain less visible than for trade in goods. And, with patently obvious NTBs rare, progress in negotiations implies efforts to reduce barriers that have some measure of justification in terms of domestic policies. This will be difficult. Such regulations—e.g., in banking—typically have a wide range of indirect impacts, few of them clear-cut. Tariffs raise prices directly; negotiators can agree to cut tariffs on wheat in exchange for reductions on computers. Many NTBs have uncertain quantitative effects; discussion can bog down in debates over the respective magnitudes of barriers. For just these reasons, the Tokyo Round had only modest success in dealing with NTBs for goods. Adding another layer of complexity, services such as shipping, air travel, and communications have long been regulated internationally on a more or less ad hoc basis. Agreements have grown up with little consistency from sector to sector, and little relationship to codes of conduct covering trade in goods.

Chapters 9 and 10 discuss the kinds of progress that may be possible. Here, the primary point is this: given the predictable difficulties in moving quickly towards liberalization, there seems little reason to give the services unusually high priority in the U.S. negotiating strategy. Liberalization in the services deserves to be a long-term goal, but other objectives are at least as important. For instance, if the United States is serious about strengthening GATT as an institution, logical priorities begin with efforts to create effective enforcement mechanisms and to close the loopholes that have permitted NTBs for goods to proliferate. In such a context, an umbrella agreement establishing a general set of rules governing services trade (see chs. 9 and 10) fits quite naturally, particularly if it could be coupled with extension of GATT coverage to foreign investment.

CONCLUDING REMARKS

The discussion above points to a number of themes that recur in the remainder of this report:

- Direct exports of U.S.-produced services will remain relatively small compared to exports (and imports) of goods, if only because of the need for an overseas presence to market so many services. Given the importance of foreign investment, justification for placing a high priority on international negotiations concerning services trade must depend to considerable extent on indirect gains to the U.S. economy.
- Major sources of indirect benefits from more open trade and investment in the

services include an infrastructure and environment internationally that: 1) can aid American exporters of goods as well as services, and 2) provide strategic support for efforts by U.S.-based multinationals to build globally integrated organizations.

- An open international economy—with relatively free flows of technology and know-how, vast pools of low-cost labor, more and more-capable competitors—will mean greater uncertainty and less stability for American firms. Given such an environment, U.S.-based firms will find themselves moving towards more flexible organizational structures, in part simply to adapt and survive—but in part also to capitalize on evolving applications of computer and communications systems.
- Flexibility and adaptiveness carry many shades of meaning, among them: heavier reliance on technology (broadly defined); decentralization and delegated decision-making; greater dependence on communication channels, both horizontal and vertical; continuing learning; rapid adjustment to competitive pressures (which may mean utilization of part-time and temporary employees to cope with fluctuating demand). In both the services and in manufacturing, new approaches to integration—geographic, and in terms of products and production processes—will help companies develop and market products with, for example, a greater degree of customization, hence higher value-added. For at least some companies, the boundaries between production of services and goods will continue to blur. Many companies will purchase more services on the outside.
- For the U.S. labor force, continued job creation in the services, coupled with a stagnant or declining manufacturing sector and new demands for flexibility, will mean: 1) relatively large numbers of new jobs in the traditional, tertiary services, 2) but also many new jobs in knowledge-based services. The former will remain at the bottom of the pyramid in terms of skill requirements and wage levels. The latter will demand high skills, rewarding them in many cases with high pay. Greater stratification within the U.S. labor market could sharpen policy-related conflicts over issues of education, (re)training, and mobility, not to mention income distribution.
- Effectively utilizing the capabilities of the U.S. labor force, and the potentialities of new and emerging technologies, will remain critical for international competitiveness in both services and manufacturing. Well-integrated organizations, making effective use of people's skills, as well as technology, will have better prospects for competitive success, for growth, and for the creation of new jobs. High value-added products, depending on high skills and able to support a high-wage economy, will in many cases result from applications of computer-related technologies that enhance rather than replace people's skills.

How can Federal Government policies support the knowledge-based industries, so dependent on human capital, that will lie at the core of a high-skill, high-wage economy in the 21st century? This report suggests that commitment to open international trade and investment, in the services as well as in manufactured goods, and commitment to economic deregulation, must carry a significant corollary: commitment to policies that help individual Americans take advantage of the opportunities created in such an economy.

APPENDIX 2A: THE SERVICE INDUSTRIES IN ECONOMIC ADJUSTMENT

Adjustment Processes

The international competitive environment for U.S.-based companies seems less stable today than even a decade ago. As other nations climb the technology ladder, competitive pressures on the United States will continue to build. New technology, shifts in domestic demand, import competition—all these force adjustment. Big changes within a short time period—in 1979-80 when the U.S. automobile industry was hit simultaneously with recession, a shift in consumer demand toward small cars (resulting largely from gasoline shortages), and rising competition from Japan—can overwhelm the economy's capacity to adjust by re-deploying resources no longer needed in declining sectors.[1] This capacity—the economy's resiliency or robustness—depends on government policies as well as economic structure. When people who lose their jobs remain unemployed for long periods, and other resources remain underutilized, this is evidence that change is being forced on an economy faster than it can respond.

Rapid shifts in one sector mean adjustment elsewhere. In the computer industry, technological improvements have led to huge increases in price/performance ratios and an ever-expanding range of applications—with impacts that wash through the entire economy. A given disturbance can hurt a small or less diversified economy more: if Americans stop spending tourist dollars in Mexico, for whatever reasons, the adjustments will be painful. Agrarian nations are susceptible to drought. The Middle East will eventually run out of petroleum. The U.S. economy, in contrast, has the advantages of both size and diversity—sources of resiliency whether disturbances are domestic (bank failures) or global (energy shock). Beyond this, adjustment will be easier if the mix of resources released by declining industries resembles that needed by expanding sectors: the shift from low-skilled factory work to services taking place since the mid-1970s creates a substantial source of disturbances, if only because the social environment of the services differs so greatly from that of the factory. As chapters 7 and 8 suggest, the rapidly growing knowledge-based services, in particular, need people with both technical skills and social skills quite unlike those of many of the Americans who earlier found jobs in traditional manufacturing industries.

Adjustment Policies

Lower trade barriers also create disturbances and force adjustment—a problem recognized in the GATT escape clause mechanism (Article XIX). The escape clause permits governments to give temporary protection to industries injured by reductions in tariffs or NTBs; governments can call on temporary protection or a variety of other policy tools to ease adjustment (retraining programs, relocation assistance, tax incentives for expanding sectors that might soak up displaced resources, R&D support for sectors expected to grow rapidly).

Many governments have viewed infant industries as worthy of protection or subsidy because of their future potential (e.g., electronics in Japan during the 1970s). On the other hand, growth rates that turn negative often call forth sector-specific responses intended to arrest or manage decline (trade protection for steel in the United States and the European Community). Whether or not adjustment is the primary motive, governments choose from a more or less standard list when seeking policies to aid a given industry: financial subsidies; protection; regulation; government procurement; funds for R&D. Direct, sector-specific intervention has seldom worked very well in the United States or in Western Europe, with most of the failures stemming from attempts to counter deep and powerful economic trends. Government aid can seldom enable industries suffering from mounting comparative disadvantage to maintain customary output levels; such policies easily become counter-adjustment measures.

Are Services Special?

Pressures for adjustment can start anywhere; service industries are potential disturbances, as well as potential buffers. While some disturbances originate abroad (oil price increases in 1973-74 and 1979-80, rising imports of steel and automobiles from Japan), differential growth rates within the U.S. economy, as well as surging foreign investments by American corporations, have created severe stresses in the past. So have U.S. Government initiatives—e.g., President Nixon's renunciation of the gold-exchange standard in 1971, following the breakdown of the Breton Woods Agreement.

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[1] Disruptions can have other causes. The 1985 Mexico City earthquake created a heavy burden of adjustment for Mexico's economy. Of course most disturbances operate on longer time scales. When change is slow, or has impacts isolated within small portions of the economy, adjustment processes can be relatively benign.

For an analysis of labor market adjustment in the United States, see *Technology and Structural Unemployment: Reemploying Displaced Adults* (Washington, DC: Office of Technology Assessment, February 1986).

Within an economy as large as that of the United States, only the banking industry among the services seems to carry the potential for major disturbances. The international banking system links national economies; any shock from the collapse of a large U.S. (or foreign) bank, perhaps resulting from too many bad loans, could spread through the system's network of interlocking deposits and credits. If other banks were to fail in a domino effect, instability in national financial markets would be only a short step away.

If only the banking industry among the services carries the potential for severe disruptions, what about the potential of service industries for facilitating adjustment? Do any of the services enhance the robustness and resiliency of the U.S. economy out of proportion to their size and their contribution to economic diversity (by, say, quickly adapting to new conditions, soaking up resources displaced elsewhere, using a shifting mix of inputs or changing their rates of output in response to new conditions)? Here, the services show no outstanding advantages compared to goods-producing industries. At the same time, the services (other than banking) should generally be able to respond to disturbances without aggravating adjustment problems. The implication: if none of the service industries have unusual potential for offsetting adjustment pressures, then none has much claim on government policies that would favor it over other industries in the name of smoothing adjustment.

Chapter 3

International Competition in Banking and Financial Services

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Chapter 3

International Competition in Banking and Financial Services

SUMMARY

Over the postwar period, few international businesses have grown as rapidly as banking. For 20 years or more, rates of expansion on many measures have been in the range of 20 percent per year. National capital markets have become more tightly integrated, mirroring linkages among banks and other financial institutions. More than 150 U.S. banks maintain branches overseas; Citicorp alone operates in more than 90 countries. Foreign banks have reciprocated, opening new offices throughout the United States.

Truly international capital markets have led to a broad range of new financial products, some of them listed in table 8 in chapter 2. Many of these new products have been introduced in the so-called Euromarket. This offshore or external market, relatively free of the restrictions and regulations that governments normally place on financial transactions, has become a highly desirable alternative for businesses seeking to place or to raise funds. Because the Euromarket is efficient, costs for both lenders and borrowers are low. Firms can issue financial instruments (e.g., bonds, notes, commercial paper) in dollars or almost any other currency. In a typical transaction, the London office of the U.S. securities firm Prudential Bache raised a total of 4.3 billion yen (about $16.7 million) early in 1985 for the Japanese robotics manufacturer Dainichi Kiko through placements with seven institutional investors in Europe.[1]

Two primary forces lie behind much of the growth and change in international banking: deregulation, and new technologies. The United States has been a leader in both, with generally positive impacts on U.S. international competitiveness in financial services. (While this chapter focuses on companies that identify themselves as banks, boundaries between banks and other financial firms have blurred; OTA has not attempted to maintain hard and fast distinctions by firm or by product.) Laws and regulations constraining banks have been relaxed or repealed. Looser regulation means opportunities for new products. Deregulation, by increasing competition, also drives down profit margins, inducing some banks to take greater risks in the hope of maintaining profitability. Governments everywhere stand behind the safety and stability of their banking systems; plainly, deregulation will only go so far. Governments will also continue to influence banking activities as they pursue macroeconomic policy and control of the money supply. The relationships between public and private sectors in banking are unique among industries.

Financial service firms have been major users, but not originators, of postwar advances in computer and communications systems. Thus technology—the other major driving force—has been an independent factor. Deregulation permits firms to broaden the scope of their financial activities; technical advances make it possible to do so efficiently, and on a global scale. Banks turned to computer technology, first, to help manage their vast flows of paperwork. Strategic applications came later, complementing back-office automation (ch. 8), with banks looking to technology for help in escaping from government regulations; offshore Eurobanking, perhaps the preeminent example, began in the early 1950s, but it was electronic funds transfers that freed offshore markets from fixed geographic locations, opening them to worldwide participation.

Today, a large American company can arrange a loan in Tokyo or place a security denominated in yen and swap the currency into dollars to be spent in the United States (or marks to be spent in Germany), at the same time swapping a fixed interest rate for a variable rate—a transaction that, while not unheard of, would have been unusual as recently as 1980. Funds flow across national boundaries as never before, and national financial systems have become tightly interwoven. Once, the effects of a major failure would have been isolated within the bank's home country; today, they could ripple around the world. While steps taken in the past few years have allayed much of the immediate concern over stability of the world financial system, future developments could easily lead to renewed fears of worldwide banking collapse.

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[1] W. Dawkins and Y. Shibata, "A Japanese Upset for Venture Capitalists," *Financial Times*, Oct. 28, 1986, p. 28.
Dainichi Kiko entered bankruptcy the next year.

This chapter examines competition in international financial services, in both offshore and onshore markets. (Onshore banking refers to operations in national markets by foreign-owned banks—for instance, Japanese banks in the United States.) With the need to focus on international banking, and the competitiveness of U.S. financial services firms, OTA has not been able to give much space to the well-publicized changes taking place in domestic retail banking, although many of these have also been driven by the twin forces of deregulation and new technologies; in U.S. retail banking, the half-dozen standard products of a decade ago have given way to a hundred or more.

The sections that follow highlight four major points:

1. The maze of U.S. banking regulations—implemented by the States as well as by Federal agencies—exerts wide-ranging impacts on the international competitiveness of the U.S. financial services industry. Rapid expansion of international banking makes these impacts much more important than just a few years ago, but policymakers give them little consideration. OTA's analysis indicates *a need for the policymaking process to reflect, on a routine rather than exceptional basis, the impacts of Federal policies on the international competitiveness of the U.S. financial services industry.*
2. Regulators confront moving targets as technological change and competitive pressures lead to continuous restructuring in world financial markets. Increasingly integrated but decreasingly regulated markets pose greater dangers of instability and world banking collapse. National regulations intended to protect depositors and ensure stability have self-limiting effects; in a competitive world, they drive banks to seek unregulated markets and unregulated products—a dynamic that can lead to greater risks. U.S. leadership in seeking greater *international coordination of banking supervision and banking regulation* could help move the system toward a more stable footing. (To some extent, the decrease in regulation has been accompanied by an increase in supervisory oversight by government bodies—i.e., by monitoring rather than control.)
3. External markets have grown as providers of capital search for higher returns, while corporate borrowers seek lower financing costs. Not long ago, corporations went to the Euromarkets for bank loans to support their foreign subsidiaries. Today, they look to these markets for securitized financing—bonds and stocks, commercial paper that can be traded in secondary markets—to finance domestic as well as foreign operations. *Securitization—the replacement of loans by marketable securities—has permanently changed the environment for international competition.* The consequences make competitive life more difficult for U.S. banks.
4. Only the Japanese seem in a position to challenge American financial services firms. As Japan's financial markets become more fully integrated into the world system—in part as a result of prodding by the U.S. Government—*Japanese financial institutions will mount major competitive challenges.* While it is too early to predict the outcomes, it is not too early to take account of this new source of competition in implementing Federal policies. For example, it is not at all clear that U.S. pressure aimed

> at opening up Japan's capital markets is in the longer term interest of the U.S. financial services industry.

In such a world, can the Federal regulatory and supervisory system continue to cope? This chapter suggests that, at the very least, the system needs modification to bring national and international considerations into better balance.

As they have evolved since the 1930s, U.S. banking policies, at both State and national levels, have generally been focused quite narrowly on the particular problems of a particular time. The policies themselves emanate from a bewildering assortment of State and Federal authorities (including, at the national level, the Comptroller of the Currency, the Federal Reserve Board, and the Federal Deposit Insurance Corporation (FDIC)). Rarely have either State or Federal agencies examined the possible impacts of their actions on the international competitive standing of U.S. banks, even though in many cases these impacts are real and apparent. The FDIC, for instance, establishes premium levels with little effort at coordination with other governments; yet international differences in these premiums alone could place U.S. banks at a competitive disadvantage.

One of the policy options in chapter 10 (option 13) would establish mechanisms for monitoring and coordinating the actions of Federal agencies as they affect the international competitiveness of the U.S. banking industry. This is not to suggest that these impacts should dictate policy, but that they should take their place with other considerations as a normal part of the policymaking process.

National banking regulations exist in part to foster confidence in the security of deposits and in the continuing viability of the system as a whole. But continuing restructuring of world financial markets, driven in part by advancing technology, can quickly make the regulations of any one country obsolete. New products, many of them securities, continually stretch the boundaries of the permissible. With sources of interest income remaining more heavily regulated than fee-earning services, banks develop new products that replace loans with other sources of earnings. As banks and other institutions develop new forms of financing, regulatory officials find themselves chasing moving targets. When the regulatory agencies react to their innovations, the banks move off in another direction.

In the United States, the responsibility for monitoring and for implementing regulatory policies shifts between agencies as new forms of financing spring up, with ultimate authority becoming diffused and confused. The problem is little different in other national markets. Internationally, the situation is still messier; regulatory structures, where they exist, remain poorly developed. The growth of offshore markets makes regulations in any and all countries less effective because financial institutions have more ways of avoiding them. Although the banks themselves benefit from a stable international environment, they have been more concerned with narrow questions that affect their ability to compete with one another. Banks and national governments are in similar positions: individually, they can do little to preserve stability internationally.

In this climate, governments have begun to consider methods for coordinating and harmonizing their regulatory and supervisory practices. The Federal Reserve and other U.S. authorities have opened discussions on the possibility of international rules for external markets. Recent proposals for a bilateral agreement with the United Kingdom (U.K.) on capital requirements may be a first step towards broader arrangements.[2] OTA's analysis points not only to the need for continuing such talks, but to the need for a thorough study of sources of possible instability.

If coordination of regulations might help, national interests will inevitably differ and widespread agreement may be hard to achieve. At this point, it is not even clear that appropriate international forums for negotiation exist. Over the past few years, the Basel Committee, an advisory group of central bankers and supervisory officials from fewer than a dozen major nations, has provided a place for discussion, but the Committee would not necessarily be the proper setting for negotiations among governments. In chapter 10, OTA suggests steps that would help focus attention on questions of international coordination and the further development of an international regime for the supervision of financial services.

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[2] See D. Lascelles, "Britain and U.S. Agree Landmark Banking Pact," *Financial Times*, Jan. 9, 1987, p. 1, and related stories on pp. 6 and 18.

What then of U.S. international competitiveness in banking? Securitization—replacement of bank loans by securities as preferred sources of corporate financing—has made deep and permanent changes in the competitive environment. Investment banks have become much more prominent in international markets because of their experience in structuring new securities issues; rapid growth has led U.S. investment banks, which remain small compared to commercial banks, to seek new capital—sometimes foreign—in order to keep pace with market expansion. At the same time, where permitted, U.S.-based commercial banks have plunged into investment offerings (regulations restrict this in the United States). U.S. commercial banks have also sought other sources of income to supplement their international lending. Some of these fee-based products—e.g., foreign exchange trading, interest rate swaps—could turn out to be riskier than anticipated.

OTA's analysis suggests that the competitive changes caused by securitization threaten the competitive position of individual banks more than that of the U.S. industry as a whole. Indeed, relative to foreign industries, the American financial services industry has done well in the rapidly shifting competitive environment of the past few years. American banks have been able to take advantage of learning and experience in their deregulated home market ahead of major foreign competitors; some of latter have invested in the United States primarily to gain experience. From all recent signs, U.S. international competitiveness in banking and financial services will remain strong. This does not mean, of course, that all American banks will do well internationally. This is an industry with many competitive firms. Some do well in some markets, some do well in others. Products are similar, technology—though not the expertise to use it—easy to come by. New financial services arise in part as banks struggle to differentiate themselves and become something other than purveyors of commodity-like products. No one can count on decisive sources of advantage or sure success in the future.

There seems only one real threat to the competitive rank of the U.S. financial services industry—Japan. Japanese banks, almost invisible 15 years ago, have become major players on the international stage. Because of continuing and massive bilateral trade surpluses with the United States and other industrial nations, Japan has become a huge international creditor, particularly in dollar-denominated financial assets. Japanese banks now hold more international deposits than their American counterparts, and far surpass any other national industry. The competitive thrusts of Japanese banks show greater sophistication today than even 2 or 3 years ago.

Yet Japanese competition has thus far made few major differences for U.S.-based financial institutions. American banks have been aggressive, innovative, and efficient—qualities that have enabled them to maintain their international position in an increasingly deregulated global environment. Could all this change, in the way it did for manufacturing industries like automobiles or consumer electronics? Could the Japanese exploit new competitive opportunities to carve out ever-larger shares of international markets? Do their onshore investments in the United States represent competitive strategies aimed at the home markets of American banks? While not impossible, and while some signs point in this direction, parallels between markets for financial services and manufactured goods can easily be overdrawn.

Banking has been a highly competitive international industry for decades, with many firms from many countries competing in a least some parts of the market. In such industries, few of the forces affecting competitiveness, in isolation, make a big difference (the way technical skills do in the commercial aircraft industry, or scale economies once did in automobile production). American banks have not been insular or insulated; they have capitalized effectively on advantages where they could find them, just as foreign banks have. Competition between the United States and Japan seems bound to intensify, with the pace largely controlled by Japan's willingness to liberalize its financial markets. The competitive threat is real, but careful monitoring of relative positions seems the appropriate response for the moment.

GROWTH AND COMPETITION IN INTERNATIONAL FINANCIAL SERVICES

Banking—the second-oldest service—was also one of the earliest to be traded internationally. Trade in goods still requires financing, but international banking today hardly resembles the industry of even a decade ago. Looser regulatory structures have bred greater competition among more banks in more parts of the world. No longer can banks live comfortably within sheltered regional or national markets. Protective barriers offered one of the few sources of decisive advantage in a business with many able competitors, quick to copy good ideas. Although much of the business continues to revolve around trade-related instruments like letters of credit and banker's acceptances, new products—particularly those sold in lightly regulated or unregulated external markets—have grown at an explosive pace. Here, the banks that have gotten in first have generally been able to maintain leading positions.

Market Dynamics

International banking deposits (as defined in table 11) have grown much faster than world trade (i.e., total world exports of goods and services). In most countries, international banking has also grown more rapidly than domestic banking; for the nations of the Organization for Economic Cooperation and Development (OECD), the ratio of foreign to domestic liabilities more than doubled during the 1970s, and has continued to rise, albeit more slowly.[3] During the 1970s, banks everywhere found their profitability slipping in traditional markets. Early responses included heavy lending to newly industrialized and less developed countries (NICs and LDCs), and to Eastern Europe. Rising oil prices meant large trade surpluses in some countries and large deficits in others; banks could get funds from oil exporting countries, extend loans to importing countries, and expect handsome profits. These loans grew to become a significant part of the portfolios of many major banks before the shortcomings of the strategy became clear to all.

During this period, American banks did about 27 percent of the total syndicated lending to these countries, about the same as their percentage of worldwide assets.[4] Worldwide reces-

Table 11.—Growth Rates of International Banking Compared to World Trade

	Annual rate of growth		
	1966-73	1973-80	1980-84
Total international banking deposits[a]	30.0%	24.4%	6.6%
Total world exports	9.2	25.2	−1.5

[a]Equal to the sum of domestic and foreign currency liabilities to nonresidents of all banks worldwide, plus their foreign currency liabilities to residents.

SOURCES: *Annual Report, Bank for International Settlements* (Basel, Switzerland: Bank for International Settlements, various years); *International Financial Statistics* (Washington, DC: International Monetary Fund, various years).

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[3] R.M. Pecchioli, *The Internationalization of Banking: The Policy Issues* (Paris: Organization for Economic Cooperation and Development, 1983), p. 16.

To take a different kind of indicator, the number of major banks having offices in banking centers outside their home countries increased from about 300 in 1970 to 550 in 1980—*The Bankers' Almanac and Yearbook*, 1970-71 and 1980-1981 (New York: I.P.C. Business Press Limited).

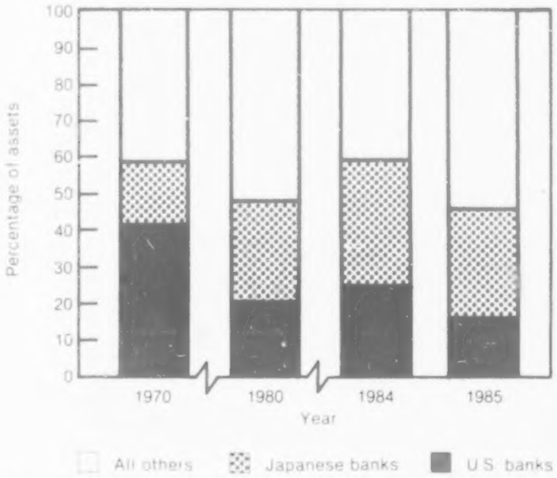
[4] "International Bank Lending Trends," *World Financial Markets* (New York: Morgan Guaranty, July 1985), pp. 5, 7.

By the end of 1986, Brazil's foreign debt stood at about $108 billion and Mexico's at $100 billion. Among countries seeking rescheduling, these two are followed by Argentina ($50 billion), Venezuela ($35 billion), and the Philippines ($27 billion). Major lenders to these countries include Citicorp (the largest single lender to Brazil and Mexico), Manufacturers Hanover, BankAmerica, and Chase; each of these banks has loans outstanding to Brazil that total more than half of its shareholders' equity. Ten or more U.S. banks have outstanding Latin American loans totaling more than their equity. See P. Truell, "Citicorp's Reed sion and falling oil prices, along with less than prudent loans, make repayment of principal and in some cases the interest on many of these obligations uncertain. In worst case defaults, the capital of even large money-center banks could be wiped out, leading to a crisis at the lending bank or banks; beyond ongoing risks of defaults, the major implication for competitiveness is that banks with high levels of risky international debt will have limited strategic options.

Big banks take most of the business in international financial services; perhaps two dozen firms with headquarters in the OECD nations account for more than half of all cross-border lending, and some 60 percent of lead managements of bonds and other securities issues.[5] Among these banks, positions have been changing. As figure 20 shows, the assets of the largest Japanese banks have been growing steadily, and now exceed those of their American counterparts. The relative shifts visible in figure 20 reflect macroeconomic factors such as differing economic growth rates and currency exchange values, among other things, with the increase in U.S. asset share between 1980 and 1984 largely a consequence of the strength of the dollar during that period.

Cross-border assets paint much the same picture. At the beginning of 1986, Japanese banks for the first time held more international deposits than U.S. banks—a gap that widened quickly during the year as the dollar weakened. As figure 4 (in ch. 1) showed, banks from other countries trail far behind. The rapidly rising assets in the Japanese financial system stem in large part from Japan's consistently high trade surpluses over the past half-dozen years. It is this growth in assets that, more than any other factor, points toward greater competitive challenges by Japanese banks.

Figure 20.—Relative Asset Shares of the World's Largest Banks[a]



[a]300 largest banks for 1970-84; 500 largest for 1985.

SOURCES: **1970-84:** *The Banker* (various issues); **1985:** "30th Annual Survey of the World's Top 500 Banks, Part II," *American Banker*, July 30, 1986, pp. 36-44.

In 1984, the latest year for which comparable data are available, Citicorp remained the largest financial institution in the world as measured by assets, with $190 billion, followed closely by five Japanese banks, the largest of which was Dai-Ichi Kangyo, at about $170 billion.[6] Measured in this way the dominance of Japanese banks as a group appears overwhelming. When measured by profits, however, Citicorp was far ahead, earning almost a billion dollars, compared to runnerup Barclays (British) at $600 million. National Westminister (another British bank), Chase Manhattan, and Manufacturers Hanover all reported greater

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(continued from previous page)

Takes Firm Stance on Third-World Debt," *Wall Street Journal*, Feb. 4, 1987, p. 6; "Risks of Foreign Banks in Latin America," *Financial Times*, Feb. 25, 1987, p. 4; E.N. Berg, "Brazil's Debt: A Key Juncture," *New York Times*, Mar. 3, 1987, p. D1.

U.S. banks are particularly affected by Latin American debt problems, with Western European banks exposed in Eastern Europe, and the Japanese in Indonesia. In lending to Brazil, Japan follows the United States, with outstanding long-term loans of $8.8 billion, compared with $18.6 billion for American banks.

[5] P. Mentre, "The Fund, Commercial Banks, and Member Countries," Occasional Paper 26, International Monetary Fund, April 1984.

[6] "International Banking: Wooing the Customer," *The Economist*, Mar. 22, 1986, p. 6; "30th Annual Survey of the World's Top 500 Banks: Part II," *American Banker*, July 30, 1986, pp. 36-44. In 1985, Dai-Ichi Kangyo became the biggest bank in the world as measured by assets, and in 1986 the biggest bank holding company as measured by assets, surpassing Citicorp.

All measures of bank size and profitability reflect dramatically shifting exchange rates, as well as differing accounting principles and banking practices.

profits than the Japanese leader, Sumitomo (which earned less than $400 million).

American banks have generally moved the fastest into fee-based services, many of which generate profits that do not translate into assets. This accounts for some of the disparity between asset and profit measures. Data presented later in the chapter show that U.S. financial institutions have large and often increasing shares of markets for major international banking products. American banks also tend to have many more foreign branches: by Sumitomo's count it has only 40 foreign branches, compared with over 1,800 for Citicorp. In summary, the big U.S. banks, while certainly not dominant, remain competitively strong.

Competition among banks is only part of the story. U.S. banks have new rivals who have entered from outside the financial services industry—not only corporations that place their own commercial paper, but companies expanding into financial services from other industries. Some, like the major department stores with their charge cards, and automobile companies with their financing subsidiaries, have been extending consumer credit for years—and earning healthy profits from these parts of their businesses. More recently, companies like Sears —which purchased Dean Witter in 1981—have sought to use their marketing skills and network of outlets to enter retail markets for financial services. Thus far, entrants from other industries have not had much impact internationally, nor have mergers between financial and nonfinancial firms been outstandingly sucessful; frequently, profits of the merged units have fallen.

Onshore and Offshore Banking

Funds move internationally in two kinds of markets, onshore and offshore. In an *onshore* transaction—e.g., when an American corporation arranges to borrow yen in Tokyo—foreigners participate through national markets. Onshore banking also takes place when foreign-owned financial institutions enter domestic markets—when a Japanese bank opens offices in San Francisco or New York, or buys an American bank. In *offshore* markets, financial transactions take place largely beyond the regulatory reach of the government issuing the currency of the transaction—the case when an American corporation borrows dollars (or yen) in London. Offshore markets, often called Euromarkets because much of the activity continues to take place in European financial centers, tend in practice to be largely free of regulation by any and all governments; they need have no fixed geographic location, and today could almost be viewed as existing in the telecommunications infrastructure.

In either onshore or offshore markets, flows of funds can be direct or intermediated. In the first case, a broker brings together a buyer and seller of securities (e.g., stocks or bonds). Direct flows of funds in the foreign sector of national capital markets mostly involve bonds. In intermediated transactions, a financial institution, usually a bank, borrows by issuing its own liabilities and lends the money to others.

Today, onshore markets for foreign bonds, concentrated in Switzerland, the United States, and Japan, total about $30 billion; continuing regulatory constraints have slowed growth, contributing to expansion in other financial instruments. Onshore markets for equity (stock) have begun to expand rapidly, although remaining small compared to foreign bond markets. While the shares of relatively few corporations are listed on exchanges outside their home countries—table 12—the numbers have been headed steeply upward, especially among the biggest companies; the 400 firms traded on foreign markets as of mid-1985 may have represented a quarter of the total capitalization of their home-country stock markets.[7] It should soon be possible to buy or sell any major stock at any time of day or night through an exchange in Europe, North America, or Asia. The emer-

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[7] "The Corporate List," *Euromoney*, February 1986, pp. 168-169. In 1983, corporations raised $83 million through new equity issues in markets outside their home countries—a financing mechanism almost unheard of previously. New Euroequity issues totaled $306 million in 1984, $3.2 billion in 1985, and the same amount in the first 6 months of 1986. See Q.P. Lim, "Equities Enter the Eurobond Age," *Euromoney*, October 1985, p. 262; and S. Lohr, "Turning to Europe for Equity," *New York Times*, Aug. 21, 1986, p. D1.

Table 12.—Companies With Shares Traded on Foreign Markets, by Home Country

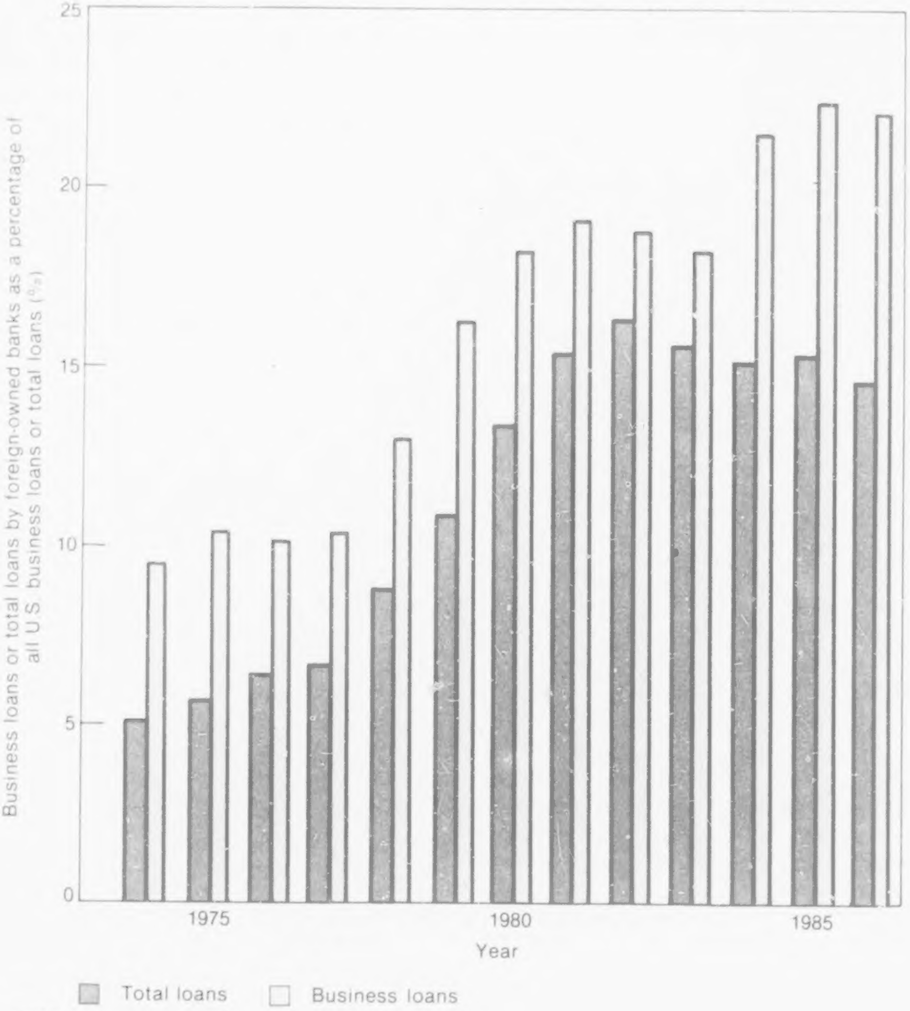
	Number of companies		
Headquarters location of issuing company	December 1983	December 1984	June 1985
United States	84	85	85
Japan	49	65	81
United Kingdom	13	25	33
Federal Republic of Germany	17	22	26
Other	73	131	175
	236	328	400

SOURCE: Euromoney, various issues.

gence of foreign markets for stocks promises to be a big step toward fuller integration of capital markets internationally, with dramatic consequences for the underwriting business.

Onshore banking through direct investment has also been expanding, spurred by a loosening of regulatory constraints in countries including Japan, Canada, Sweden, Taiwan, and Australia. Figure 21 shows the steady expansion of foreign bank lending in the United

Figure 21.—Lending in the United States by Foreign-Owned Banks



NOTE: Percentages for December of each year, except June 1986.

SOURCE: Federal Reserve Board, unpublished data, November 1986.

States. New York, as a major international banking center, has been home to many foreign bank offices for years: Bank of Tokyo's New York office was founded in 1880. But expansion elsewhere, and particularly in retail banking, is a newer phenomenon; Japanese banks have become much more visible in California (Sumitomo Bank of California, California First, Bank of California). In 1975, the foreign assets of U.S. banks (outbound banking investment) greatly exceeded the assets of foreign banks in the United States (inbound); since then, outbound growth has been slow compared to inbound, and today inbound and outbound banking investment are about equal.[8] Box F summarizes reasons for the growing foreign bank presence in the United States, while a later section looks more closely at the strategies of Japanese banks.

The external or offshore markets function quite differently. Eurodollar bonds, to take an example, are denominated in dollars but bought and sold outside the United States, typically in London. Most Euromarket transactions involve the U.S. dollar, but participants (buyer, seller, underwriter) need not have their main businesses in the United States. Likewise, an American bank might underwrite a corporate bond in London denominated in yen that is sold to a French bank and raises money for a Brazilian firm; U.S. laws prohibit commercial banks from underwriting such an issue here.

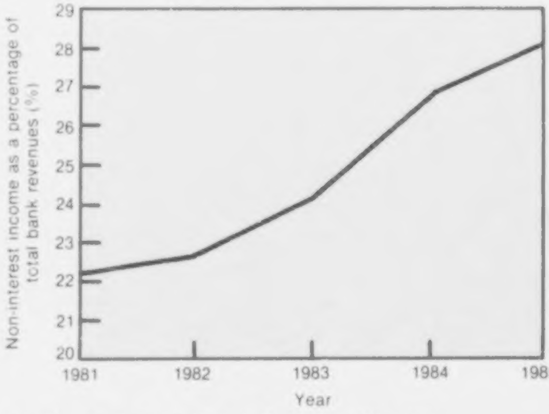
While London has traditionally been the center of the offshore market, Singapore and New York have seen rapid growth in recent years. Fierce competition has led to reduced operating costs and rapid expansion. In 1965, the Eurodollar market was less than 10 percent as large as the domestic U.S. financial market—$12 billion versus about $170 billion. By 1983, the Eurodollar market had surpassed $800 billion, more than half the size of the U.S. domestic market. Direct financing, mainly Eurobonds, has been growing considerably faster than the intermediated transactions that also take place in external markets. (Lack of regulations and reporting requirements in offshore markets means that their size can often be estimated only roughly.)

Expanding external markets go hand in hand with newer banking products that facilitate international flows of capital (table 8, ch. 2). Telecommunications links (box G) have spurred growth in interest rate and currency swaps. (Swaps, explored more fully later in the chapter, involve the exchange of one financial asset or obligation for another.) The annual volume of outstanding interest rate and currency swaps has grown beyond $300 billion. With these and other new banking products (e.g., standby letters of credit, also described later), banks earn fees for their services rather than interest. As figure 22 shows, fees have been growing relative to interest as a source of revenues for U.S. banks. The shift toward fees is probably greater for international banking than for domestic operations.

Securitization

Perhaps the most striking and most significant change in financing practices—a change that has accompanied the rise of external markets, and contributes to the growth of fee-based services—stems from securitization. A company seeking financing can, in general, do so either by borrowing from a financial institution or by issuing a security such as a bond or stock. Likewise, those with money to invest can deposit funds in a financial institution or buy

Figure 22.—Growth in Fee Income Relative to Interest Income for U.S. banks



SOURCE: *Federal Reserve Bulletin*, September 1986, p. 627.

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[8] Federal Reserve Board, unpublished data.

Box F.—Foreign Banks in the United States

Figure 21 shows that foreign banks increased their onshore business in the United States quite rapidly during the 1970s. Some of this growth has followed naturally from rising international trade and expansion in foreign economies. Have competitive shifts played a part? Answers to this question begin with the reasons that foreign banks invest in the United States.

The first of these, as in so many industries, is the size and lucrative nature of the U.S. market. New York City is the world's largest center for financial services. Any bank that sees itself as multinational will seek customers among American corporations, along with access to a base of dollar deposits and the discount window of the Federal Reserve System. Not only is the banking infrastructure more advanced here than elsewhere, but financial services have been deregulated ahead of other parts of the world. Foreign banks establish or expand U.S. operations in part to gain experience in a comparatively deregulated environment, one they expect to spread to their home country and to other markets within which they do business.[1] Differences in national regulations also create strategic opportunities: for instance, the mix of U.S. and foreign regulations that apply to branches and agencies in the United States may result in lower costs for some financial service products—e.g., business loans—for some foreign banks. Other reasons for investing in the United States include the following:

- Foreign banks, many of which operate on a nationwide basis in their home markets, may feel that they will have advantages over less-experienced U.S. institutions as interstate banking spreads.
- Until passage of the 1978 International Banking Act and subsequent legislation, foreign banks were treated differently than American banks, arguably to their benefit. Moreover, U.S. antitrust policy has made it easier for foreign banks to purchase troubled financial institutions, or bank units sold for strategic reasons—a quick and easy entry to fundamentally profitable markets. For example, when Bankers Trust decided to deemphasize retail banking in the New York City area in 1979, it sold most of its 106 branches to three foreign banks.[2]
- Some foreign banks, less burdened by risky debt in developing countries than their American competitors, have greater strategic freedom.
- Just as American banks followed American corporations overseas, Japanese and some European banks have moved into the United States to serve their corporate clients.
- Finally, entering the United States will make sense for any bank with reason to believe it can compete; initial entry into the U.S. market serves as a test. Rapid expansion can follow if the bank finds itself to be highly competitive, or if the fluid environment here should shift in its favor.

Despite the *possible* sources of advantage mentioned above, the U.S. operations of foreign banks have seldom been particularly profitable.[3] While there are many reasons for foreign banks to seek an onshore presence in the United States, there is little evidence that the expansion illustrated in figure 21 points to competitive advantages over U.S. banks. And of course these banks are not selling services supplied from overseas, but services produced here with the aid of U.S. workers, the U.S. banking infrastructure, and, often, U.S. capital.

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[1] See, for example, K.A. Grossberg, "Japan Checking Out U.S. Banking Revolution," *Wall Street Journal*, Feb. 6, 1986, p. 24.

[2] Bank Leumi Trust, National Bank of North America, and Barclays—E. Compton, *Inside Commercial Banking*, 2d ed. (New York: Wiley, 1983), pp. 93-94, 199.

[3] See, for example, N. Gilbert, "Foreign Banks in America: They're Still Coming," *Euromoney* August 1985, pp. 150-156. Of course, banks, like firms in any industry, sometimes choose to sacrifice profits to buy market share.

Box G.—Technology in Banking: Electronic Networks and Cash Management Systems

As in so many of the services, new technologies in banking mean, first and foremost, applications of digital computers and telecommmunications sytems. Banks have been leaders in applications since computers began to spread in the business world. Today, back-office paperwork functions—e.g., check processing—are highly automated; transactions processed overnight a few years ago can be handled immediately. Larger financial service firms continue to invest hundreds of millions of dollars annually in new software and hardware, with much of the investment now going to support new products rather than the automation of existing operations. Fault-tolerant systems cut down on errors, with some banks investing millions of dollars for backup systems that may never be used—but if needed, could save far greater sums (see the Bank of New York example below).[1]

Banks are also learning to use computers analytically—for risk analysis and decision support—as well as for routine transaction processing. Simple computer programs can calculate a range of possible repayment schedules for proposed loans; complex programs analyze price trends of thousands of Eurobonds each day. Software developed by Bankers Trust reputedly gives the company's foreign exchange traders a 10 second advantage over the competition, enough time to execute four or five trades. Soon, expert systems will be available in the form of computer programs that embody the decision rules followed by experienced foreign exchange traders. The expert system will never be as good as the true human expert, whose storehouse of experience leads to judgements and intuitions that cannot be reduced to rules the computer can follow (ch. 8). But expert systems will help the inexperienced to learn, the inexpert to perform better, and the true expert to avoid errors. Among those recently surveyed, about 20 percent of American financial institutions had already begun to install expert systems, with another 40 percent planning to do so over the next few years.[2]

Networks.—Banks communicate and transfer funds through computers linked to form value-added networks (VANs, ch. 5). Member banks can transmit messages both domestically and across national borders via SWIFT (Society of Worldwide Interbank Financial Telecommunications), which began operations in Europe in 1977 and now links nearly 2,000 locations in over 50 countries. Jointly owned by more than a thousand banks, the SWIFT system currently handles almost a million messages each day.

SWIFT transmits messages between banks, but not funds. These are the province of other computer networks. Normally, any international transfer involving dollars will make use of CHIPS (Clearing House Interbank Payments System), controlled by a dozen large New York banks (the clearinghouse banks) and connecting 140 U.S. and foreign-owned institutions, all in New York City. (Three of the clearinghouse banks—Marine Midland, National Westminister Bank U.S.A., and European American Bank—are subsidiaries of foreign companies.) CHAPS, a similar network in the United Kingdom, serves the large London banks. In a typical transaction:

- Bank A in London has a correspondent relationship with Bank B in New York and wishes to transfer funds to Bank D in Tokyo which has a correspondent relationship with Bank C in New York. B and C are CHIPS members.
- After message traffic between A and B concerning the transaction, perhaps over SWIFT, B enters codes for itself and for the receiving bank C into its CHIPS terminal, along with the sum to be transferred and the identity of bank D.
- The message goes to the central CHIPS computer, where it is stored temporarily.
- The sending bank B must next transmit a verification for the release of funds. The cen-

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[1] On backup systems, and applications mentioned in the next paragraph, see R.B. Schmitt, "The Technology Gamble," *Wall Street Journal*, Sept. 29, 1986, p. 10D.

New technologies used in retail banking—e.g., automatic telier machines (ATMs)—have more visibility but little to do with international competition. Their main effect is on the price and quality of retail services domestically.

[2] "The Future of Technology in the Financial Services Industry," *American Banker*, Apr. 14, 1986, p. 14. Coopers and Lybrand, which conducted the survey, found that more banks than insurance companies, brokerage firms, or investment houses expected to use new technologies like expert systems as competitive weapons. An analyst at Arthur D. Little has estimated that 35 percent of the largest U.S. financial institutions will install prototype expert systems during 1987, compared with 5 percent in 1986—W.M. Bulkeley, "Computers Take on New Role As Experts in Financial Affairs," *Wall Street Journal*, Feb. 7, 1986, p. 23. For further examples of expert systems applications, see B.J. Feder, "The Computer As Deal Maker," *New York Times*, Aug. 14, 1986, p. D2; also, L. Kehoe, "White Collar Robots Go To Work," *Financial Times*, Aug. 5, 1986, p. 9.

> tral computer then debits the CHIPS account of B, and credits the account of the receiving bank C (retaining a permanent record). Bank C informs Bank D that the transaction has been completed:

Normally, each of the 140 banks will settle its account with CHIPS at the end of the business day. Final settlements use FedWire—another network, this one operated by the Federal Reserve System. FedWire, which links about 6,300 financial institutions in the United States, nets transactions immediately.

Many other networks also provide electronic funds transfer services, with about 60 automated clearinghouses (ACHs) currently operating in the United States. In contrast to CHIPS, most ACH transactions are relatively small. They also provide services to firms outside the banking industry—e.g., direct deposits of employee paychecks. Other computer networks provide quotations and execute trades of commodities and securities. Non-financial firms can tap into almost any of these systems with an electronic cash management system, as discussed below.

Multinational banks commonly operate private international networks for communications between branches—e.g., Manufacturers Hanover's Geonet. A common pattern consists of service centers in major financial markets, from which further spokes fan out. Hongkong and Shanghai Bank, for instance, operates a telex network linking more than 100 offices in over 60 countries based on leased lines (cable and satellite) and switching centers in Hong Kong, Britain, the United States, Bahrain, and Australia. The company also has a newer computer network, only partially completed, which operates at much higher speeds. Independent vendors such as GEISCO, Telenet, and Tymnet—all of which offer specialized services for banks—provide a further set of alternatives for message communications and securities transactions.

The greater the speed with which message, clearing, and settlement systems function, the greater the opportunities for banks to make profits on certain kinds of transactions. On the other hand, when the time lags between messages, clearing (transactions booked), and settlement (payment made) decline, financial institutions have less chance to take advantage of floats, the de facto interest-free loans made possible by these lags.

Implications for Stability.—Computer networks are never foolproof. A highly publicized failure cost the Bank of New York about $5 million during a 2-day span in November 1985. The bank, which does a very large business in government securities, normally receives and makes payments on these securities almost simultaneously. A software error in the firm's system left it liable for payments without receiving the corresponding credits. Before discovering the problem, the bank ran up a $32 billion overdraft with the Federal Reserve. The $5 million in interest charges came to about 5 percent of the bank's annual earnings.[3]

As message, clearing, and settlement networks evolve toward greater complexity and greater speed, the probabilities of system failures may not rise, but their consequences certainly will. When, for instance, payments moved through the mail, failure of a bank might be a process taking weeks. Regulatory authorities could monitor the situation and intervene if appropriate. Now a bank could fail almost instantaneously.

Cash Management.—For many years, banks provided services to corporations in exchange for the interest-free use of funds on deposit. With rising interest rates, corporations began to view this as a bad bargain; today, corporate treasurers manage their cash balances and short-term assets much more aggressively, as they have always managed long-term funds. Banks have been faced with the loss of more than the interest income. Many of their traditional customers now have the ability to manage their own cash, should they choose to do so. Typically, the banks have restructured their products and accounts in response, and introduced new computer-based technologies to offer corporations a package of cash management services that can handle not only currency, collections, and disbursements, but transactions in commercial paper, short-term notes, and foreign exchange.

For a multinational corporation (MNC), the cash management system will aggregate information from, and move funds among, branches and subsidiaries around the world. In effect, the bank helps the corporate treasury operation improve its efficiency—for instance, by sweeping all idle cash into an investment account on a daily basis.[4] The bank gives up the use of the higher balances the corporation once maintained, but gets fees for the new services it provides. The corporation gets an integrated package, without having to put the system together itself (although some do). Already, cash management systems may provide direct access to market quotations and execution of buy and sell orders. In principal, a company can centralize almost all its cash management functions at a single treasury work station (a computer terminal or PC). Thus far, perhaps a thousand treasury work stations have been installed worldwide—most of them in the United States; as experience accumulates, they will probably become much more popular.

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[3] J.M. Berry, "Computer Snarled N.Y. Bank," *Washington Post*, Dec. 13, 1985, p. D1. Trading in government securities averages about $200 billion daily.

MNCs and other large corporations deal with many banks, most or all of which must participate for a cash management system to function efficiently. The major U.S. commercial banks pioneered integrated cash management services, at home during the 1970s and internationally beginning in the early 1980s. Differences in tax laws and banking regulations, as well as restrictive telecommunications policies, have led to complications abroad, with many foreign banks reluctant to participate. At present, for example, Japan's Ministry of Finance permits a computer link between a corporation and a bank, but prohibits electronic funds transfers; the Ministry plans to remove this restriction once Japanese banks have become more competitive in cash management technologies. While the larger European banks have also begun to develop their own systems, their software remains far behind the best U.S. practice. A survey of 60 large multinational banks, with headquarters in Japan, North America, and Europe, revealed that many depend heavily on American cash management technology.[5]

securities directly. Securitization refers to the growing tendency for those on both sides—funds seekers and investors—to choose securities, and for these securities to be traded in secondary markets. Banks can securitize existing loans by selling the right to collect the interest and principal. Individuals securitize when they purchase shares in a money market mutual fund as an alternative to demand deposits.

Securitization reduces the demand for traditional financial services, particularly by larger customers: a corporation that once borrowed from a bank may now issue commercial paper directly. And in some cases, the bank's intermediary role—bringing together investors and those looking for financing—declines. But in other cases, even with securitization the bank continues its traditional functions, particularly those of managing the sizes, risks, and maturity of assets and liabilities; financial intermediaries collect small deposits and make large loans (and use demand deposits to fund term loans), and substitute their own creditworthiness for that of the borrower.

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[4] RJR Nabisco (formerly RJ Reynolds) says it saves $20 million annually through cash management techniques. For instance, the company can now match a need for Deutsche marks 6 months in the future to pay for German tobacco machinery with an expected inflow of marks from overseas subsidiaries. Previously, it would have purchased a forward contract from a bank to lock in the price of the machinery in dollars. See "How the Last Became First," *Euromoney*, February 1986, p. 39.

[5] "New Directions in European Cash Management," Business International, 1985. While most banks in most countries, including the United States, had developed their own software, 16 of the 60 worldwide chose Chemical Bank's BankLink. Outside the United States, software from National Data Corp., also an American firm, was the second choice to BankLink. Of the four Japanese banks surveyed, none had developed their own software, all looking instead to U.S. suppliers.

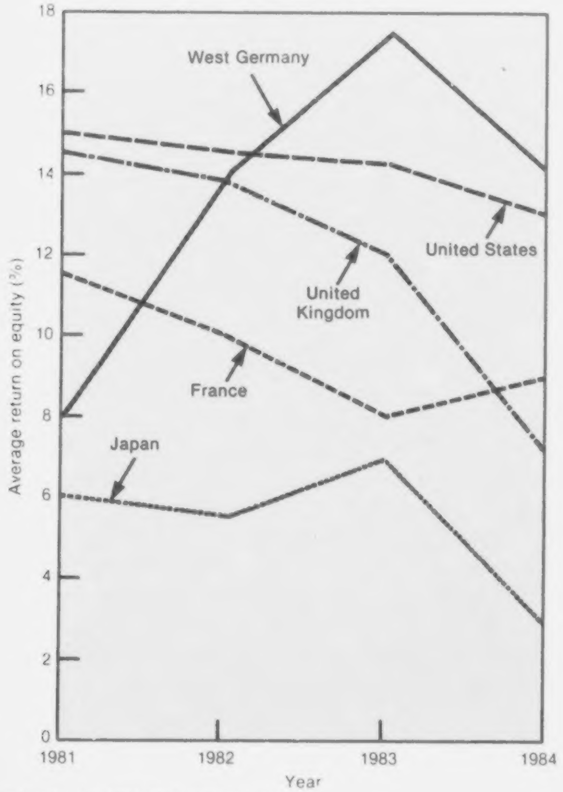
The survey painted a similar picture for network services. GEISCO, a General Electric subsidiary, supplied VAN services to half the overseas banks, and more than half the American banks. Overseas, local post, telegraph, and telephone authorities (PTTs) were second to GEISCO, with other U.S. firms, such as ADP, also providing services both in the United States and abroad. Four U.S. banks maintained private networks, but only 2 of 34 foreign banks.

A survey of corporate treasurers internationally ranked Citibank at the top of commercial banks providing electronic cash management services, followed by three other U.S. banks—BankAmerica, Chase, and Chemical. See "Corporate Finance," *Euromoney*, March 1985.

INTERNATIONAL BANKING STRATEGIES

Profitability in banking has been dropping—figure 23.[9] While competition has intensified in lending, the traditional core of the business, loans have been diminishing relative to fee-earning services as a source of earnings. Regional and national markets, once comfortably segregated, have been opened to new entrants, domestic and foreign. Securitization has cut into customary sources of profit. With more intense competition, particularly in familiar lines of business, banks have searched for new strategies that might help them earn profits at accustomed levels.

Figure 23.—Return on Equity in Banking, Five Countries



SOURCE: *The Economist*, Mar. 22, 1985.

Broadly speaking, deregulation has pushed financial institutions into riskier endeavors as they have sought to avoid the devolution of banking into a commodity-like service. They have developed new products, sought out new onshore and offshore markets, and, where possible, tried to move from commercial banking into related services—notably, securities trading and investment banking. In an industry like this, with many able competitors, competitive success normally comes through the accretion of small advantages. How well U.S. banks do in finding new and profitable markets will be perhaps the single most important factor in determining their future competitiveness. Regardless of whether the industry as a whole rises or falls relative to others in the world, some American banks will probably do quite well, and some might do quite poorly.

New and/or Rapidly Growing Product Markets

Banks that can identify and develop new products ahead of the competition can often generate relatively large returns, at least until their rivals catch up. Even then, product differentiation may offer continuing competitive advantages. Thus innovative financial products have been central elements in the strategies of American banks. Most of these products are not so much new ideas as existing products that have seen rapid growth because the combination of market conditions (inflation, exchange rate instability, deregulation, the Euromarkets, securitization—see box D in ch. 2) and new technologies (computer networks, telecommunications) makes them attractive both for financial firms and their customers.

The pervasiveness of regulations complicates innovation in this industry. Government policies in both the United States and Japan, for instance, have restricted the spread of ATMs.

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[9] No comparative data more recent than that in the figure is available. Both the largest and the smallest U.S. banks showed further drops in profits during 1985; although average profit levels for all U.S. banks rose in 1985, reversing a 5-year decline, Continental Illinois' return to profitability accounts for the entire gain. See D.J. Danker and M.L. McLaughlin, "Profitability of U.S.-Chartered Insured Commercial Banks," *Federal Reserve Bulletin*, September 1986, p. 618.

Because of differing accounting rules, absolute values of return on equity across countries have little significance.

Photo credit: Hong Kong Trade Development Council

Hong Kong's financial district

U.S. regulations generally allow withdrawals in two or more States, but deposit-taking across State boundaries has been limited by restrictions on both bank holding company activity and interstate banking. Japan permits ATM use only during certain hours, thus curbing one of their principal attractions—around-the-clock access. In both cases, regulations limit the advantages that innovating banks can expect.

Other innovations have come in direct response to regulation. In the 1970s, high U.S. interest rates, combined with regulatory limits on the interest banks could pay on deposits, led to the creation of money market mutual funds. Reserve requirements on deposits in the United States, and restrictions on capital movements here and elsewhere, contributed to the expansion of the Euromarket relative to more regulated capital markets during the 1970s and 1980s.

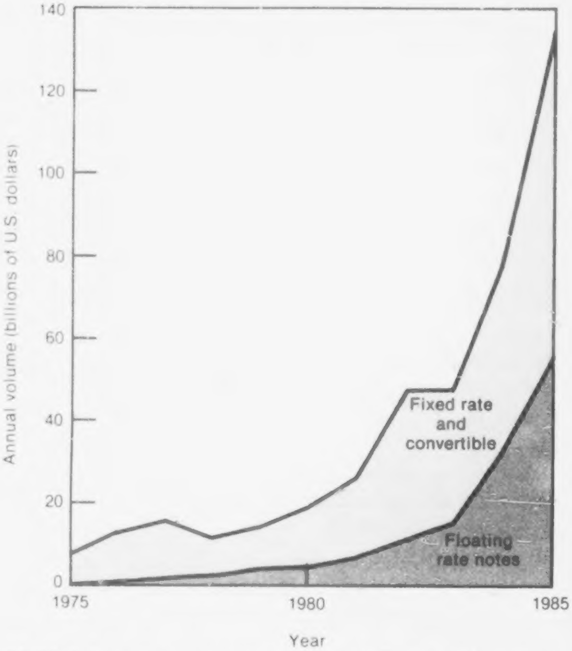
When new banking products circumvent existing regulations, national governments may respond by reinterpreting legislation or passing new laws. Alternatively, regulatory authorities may view the innovation as desirable, and perhaps liberalize the rules further. Internationally, deregulation has proved contagious: MNCs and other major bank customers can often choose the country and the banks—thus the regulations—they wish to deal with. National governments that fear the loss of valued customers then must liberalize their own regulatory structures. After fixed commissions were abolished on the New York stock exchange, trading volumes rose: the London exchange was eventually forced to follow suit. Liberalization of the London financial market, in turn, has brought in new business from Paris and elsewhere on the continent, with liberalization in many parts of Europe following.

Deregulation has also spread to Japan. Until recently, Japanese corporations could not issue Euroyen bonds (bonds denominated in yen and sold in the Euromarket). Japanese corporations seeking to participate in the Euromarket were forced into other currencies, where Japanese banks tended to be less competitive. The government's decision to permit a Euroyen market (corporations still must meet certain financial tests) represents a concession to this reality. Still later, the authorities permitted an offshore market to develop in Japan (operations began in December 1986).

Eurobonds and Euronotes

Eurobond issues grew at about 30 percent per year between 1975 and 1985—figure 24. New Eurobond and Euronote issues totaled about $136 billion in 1985 and an estimated $180 billion in 1986.[10] Lack of regulation in the Euromarkets means lower issuing costs for the banks, and lower margins for customers. Customers as well as banks may be able to bypass domestic constraints; South Korean firms, for instance, have sought medium-term financing in the Euromarket because inflation, uncertainty, and government restrictions have prevented the development of a medium-term domestic bond market in Korea.

Figure 24.—Growth of the Eurobond Market



SOURCES: *Euromoney*, various issues; "Recent Innovations in International Banking," Bank for International Settlements, Basel, Switzerland, April 1986, p. 163.

Eurobonds come in three varieties: 1) traditional fixed rate bonds; 2) floating rate notes (FRNs—issued with maturities up to 7 years and paying interest at rates periodically adjusted to reflect prevailing short-term rates); and 3) convertible Eurobonds (which bear fixed rates but can be converted into equity shares of the issuing firm—in recent years these have never exceeded about 10 percent of the total market). As figure 24 indicates, new FRN issues have grown especially quickly; first marketed in 1978, by 1984 they accounted for 40 percent of the Eurobond market.

Table 13 shows that U.S. financial services firms have had by far the greatest share of the Eurobond issue market, doing even better in the rapidly growing FRN segment. American firms manage nearly 60 percent of issues denominated in dollars, and about two-thirds of all Eurobond issues for U.S. corporations. (Box H expands on the significance of the dollar as the primary currency of international trade.)

Trade Financing and Other Fee-Earning Services

One of the oldest international services provided by commercial banks, trade financing, continues to expand. Such traditional businesses as *letters of credit* (LCs), whereby banks endorse their customer's creditworthiness, are now carried out largely through the telecommunications infrastructure. Clients can request LCs electronically, using standard formats, with many of the communications handled via SWIFT or such U.S.-based data processing organizations as GEISCO and ADP. Paperwork costs have been cut, and the process is now much quicker—a matter of hours rather than weeks. (Citibank claims it can issue a letter of credit in a matter of minutes.) While the United States led in automating this process, some European banks, especially in Scandinavia, have developed competitive systems.

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[10] "Key Figures," *Euromoney*, February 1986, p. 170; "International Bonds: A Profitable Year for Borrowers," *Financial Times*, Dec. 29, 1986, p. 13.

Shorter maturity bonds are known as notes.

Table 13.—Eurobond Issue Managers by Country

	Percentage share of new issues, 1984		
	Floating rate notes	Fixed rate notes	Overall
United States	53%	35%	44%
Federal Republic of Germany	3	20	12
Switzerland	11	8	11
United Kingdom	13	6	10
France	11	4	8
Japan	2	10	8
Subtotal	93%	83%	93%
Others[a]	7%	17%	7%

[a] Includes smaller issue managers from countries listed, as well as countries not on the list.

SOURCE: *Euromoney*, various issues.

Box H.—The Role of the Dollar

Many of the world's financial transactions are denominated in U.S. dollars, even when the parties have no relationship to the United States. Trade between Japan and North Korea, for instance, has commonly been conducted in dollars. While the continuing importance of the dollar creates competitive advantages for U.S. banks, these advantages are small, and will no doubt decline further in the years ahead.

Why is the dollar so commonly used? Many of the reasons are historical. Before World War II, the British pound had been the world's primary currency for international transactions. But the major European currencies did not return to convertability until 1957. The dollar has kept its role since, in part because the United States provides an unmatched banking infrastructure, with well-developed markets for holding short-term balances, in addition to political and economic stability. Moreover, the volume of international capital flows involving American companies, particularly during the 1950s and 1960s, also made it natural to continue using dollars. But decisions by residents of other countries to use the dollar—or any currency other than their own—depend on relative attractiveness, and most of these factors have less weight today than in earlier years. As market participants have diversified across currencies, the Deutsche mark (DM) and the yen have slowly gained in market share. Indeed, the yen has become almost as popular as the DM, one among many signs of the integration of Japan's financial system into the world system.

What advantages, if any, accrue to financial institutions doing business in their home currency? The first point is this: the more open and better developed the market, the less the advantages for domestic banks. Even in such countries as the United States, however, regulatory/administrative factors tend to tip the scales a bit. A second factor, related but distinct: domestic banks normally dominate the clearing (payment) system in their currency. Other banks bear costs (through their balances with members of the clearing system, as well as the fees they pay for services). For such reasons, domestic banks tend to have a competitive edge—small but potentially significant—in transactions involving their home currency. Even in the free-for-all external markets, U.S. ownership helps in attracting U.S. dollar deposits, while German bank branches do better in attracting DM deposits. With continuing deregulation, and movement toward globally integrated financial markets, such advantages will probably continue to erode. Even so, as pointed out at many places in this chapter, banking is a highly competitive business; a superior position must be built piece by piece, and each piece counts.

Standby letters of credit (SLCs) also substitute a bank's credit standing for that of the client. The market for SLCs—agreements to lend money should other prospective lenders refuse to do so—grew from almost nothing in the early 1970s to nearly $150 billion by 1984. Five large banks—Citicorp, Manufacturers Hanover, BankAmerica, Chemical, and Bankers Trust—account for more than a third of the U.S. total. Foreign banks, too, have been quite active in SLCs, with Barclays' New York branch reporting that in some months its letter of credit business exceeds its loans.

The fees a bank can charge for SLCs depend in part on market judgments of the bank's riskiness; if a bank has a high credit rating, its guarantee will be worth more. Because of their exposure in developing countries, U.S. banks have been viewed as relatively risky; many have been hard-pressed to compete with their Japanese and European counterparts. (Of the major U.S.-based banks, only Morgan Guaranty still has the coveted AAA rating.) Indeed, Japanese banks have recently backed tax-exempt State and municipal bonds in the United States, including issues by Michigan, and by the cities of Chicago and Philadelphia.

A *banker's acceptance* (BA) guarantees payment of a trade debt. These time drafts can be traded in a secondary market which, in the United States, amounts to about $80 billion annually. More than half of this represents third-country BAs, involving neither U.S. imports nor exports. The third-country portion of the market reflects, not only the prominence of the U.S. dollar in international trade, but the ability of U.S. financial institutions to capture business from banks in other nations also willing to deal in dollar obligations. Thus, the recent announcement by the Japanese Government that it will allow a yen-denominated acceptance market may or may not represent much of a threat to American banks. To the extent that the yen makes inroads on dollar-denominated BAs, banks based in Japan will have something of an advantage. Still, even in a yen acceptance market, U.S. banks might be able to remain competitive because of their accumulated experience.

Financial *swaps* enable two parties with advantages in different segments of the market to exchange (swap) their obligations. Banks earn fees for arranging these transactions—another example of the growing importance of non-interest income. New variations have fostered enormous growth in the market. Recently, much of the expansion has been in cross-currency interest rate swaps. For an example, consider that a Japanese firm seeks fixed rate financing in dollars, while an American company wants floating rate financing in yen. If the Japanese firm can borrow yen relatively cheaply, and the American firm dollars, they will be able to swap their interest rate obligations to their mutual benefit. The bank serving as intermediary absorbs the credit risk of each party. Many actual transactions become much more complicated than this example, involving three or more currencies and other complexities.[11] Because these transactions involve only a contingent liability on the part of the bank, they remain off the balance sheet, although some larger banks have begun to take swaps onto their books by offering a swap to one party even if no counter-party has yet been found.

U.S. commercial and investment banks have been leaders in the market for swaps, where success depends on efficiency, inventiveness, and quick response. Citicorp alone accounted for some $25 billion in swaps in 1985. Only one British investment bank (SG Warburg) and one French bank (Paribus) have established positions comparable to even the smaller U.S. players. Banks have developed the swap market largely in response to the needs of their clients. For commercial banks, these are mostly corporations. The leading investment banks—which include Salomon Brothers, First Boston, and Goldman Sachs—often arrange swaps for other financial institutions, especially savings and loan associations.

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[11] In March 1986, American Express raised 20 billion yen in the Euroyen market, which it swapped into $109 million and then into securities denominated in eight different currencies, some of these securities at floating rates and some at fixed rates—L. Wayne, "New Broader Role for Finance Officers," *New York Times*, Oct. 20, 1986, p. D6.

Many of the financial products discussed above—banker's acceptances, SLCs, swaps—share a common characteristic: they do not appear on the books of the bank, but the bank guarantees the credit of other parties. Regulators have been concerned over the growth of these possibly risky activities; governments require banks to maintain reserves of capital against their assets (mainly loans, but also treasury and other securities), in part to protect consumers and other depositors. To the extent that banks develop and market financial products without creating assets on their balance sheets, they avoid these requirements (and the associated costs). A bank that guarantees a loan may be able to collect a fee almost as large as the interest it could have earned if it had made the loan itself. Likewise for a swap, the bank guarantees payment of interest by both parties but neither of the swapped instruments becomes an asset or liability of the bank.

Regulatory authorities have looked askance at this de facto loosening in control. In most cases where governments have begun to count such items against capital requirements, they have viewed SLCs, swaps, and other guarantees as much smaller risks than loans. But the fact remains that, at this point, no one is in position to judge the real risks: growth in many of these markets has been very rapid; experience remains limited. In general, the United States has been slower than other industrialized countries to extend capital adequacy requirements to off-balance-sheet items. U.S. policy, therefore, seems to have had the effect of inducing American banks to market off-balance-sheet products more aggressively than their foreign competitors. So far, the result has been to help U.S. banks capture large shares of these markets.

Movement Into Investment Banking

Many commercial banks see attractive strategic opportunities in investment banking—trading in securities, underwriting stock and bond issues, arranging mergers and acquisitions. Investment banking holds out the prospect of recovering lost profitability: commercial banks do well to earn 15 percent on equity, while rates of return above 30 percent are far from unknown among investment banks (which do not take deposits or make loans). An American commercial bank contemplating a move into investment bank faces two sets of obstacles, the first legal and political, the second organizational.

The Glass-Steagall Act and other U.S. legislation bars firms from engaging in both commercial and investment banking in the United States (although American firms can do so overseas). While Japan maintains restrictions similar in some respects to those imposed in the United States, few other foreign governments maintain this regulatory separation; in countries including the Federal Republic of Germany, Switzerland, and the Netherlands, so-called universal banks underwrite corporate securities, offer mutual funds, and engage in the full range of stock brokerage activities. The freedom granted U.S. commercial banks to function as investment banks aboad has been one of the factors spurring expansion of the Euromarket (where, however, American investment banks have performed better than commercial banks in managing Eurobond issues, products similar to those investment banks work with at home).

In recent years, commercial banks have moved into new businesses domestically that test the limits drawn by U.S. law. Often, the courts have been asked to decide the merits of the arguments for a liberal interpretation of the restrictions, as put forward by commercial banks, versus the stricter standard suggested by investment banks. (The much smaller investment banks have not sought to move into commercial banking.) Two current examples:

1. Should Bankers Trust be permitted to broker commercial paper for its corporate clients? A Federal Appeals court in December 1986 ruled in favor of Bankers Trust, overturning a district court finding that had reversed a Federal Reserve decision. The Securities Industry Association quickly signaled its intent to appeal to the Supreme Court.

2. The Federal Reserve is expected to decide in 1987 whether commercial bank holding companies will be permitted limited underwriting of municipal revenue bonds and certain other securities.

As these examples suggest, and as discussed in more detail in the section on "Policy Issues" below, the separation of commercial and investment banking in the United States has been slowly breaking down, in part because new banking products blur some of the traditional distinctions. But if the erosion of Glass-Steagall and other restrictions continues, as it no doubt will, U.S. commercial banks face another obstacle in moving into investment banking—differences in organizational patterns and managerial style suggested by the saying that "bankers live off their assets, merchant bankers [i.e., investment bankers], live off their wits."[12] In the United States, managing a combined organization means reconciling such differences, a process that will take time and during which other opportunities might slip by. Plainly, greater freedom from legal restrictions would lead the larger commercial banks to venture further into investment banking. Some would probably be successful. Others might have trouble mastering new and unfamiliar lines of business, perhaps eventually withdrawing to more familiar territory.

Finding Profitable Market Segments in Commercial Banking

Onshore Retail Banking

Overseas retail banking has seemed a relatively conservative choice for banks seeking greater profits. Here, size by itself seldom provides much of an advantage, but new products, good service, and aggressive marketing hold out the promise of substantial rewards. Indeed, foreign banks have moved into the United States no doubt feeling they could offer better quality services and/or undercut their rivals' costs. The rapid spread of credit card services (e.g., Visa, Master Card), now offered around the world through joint ventures owned by participating banks, provides another example of international expansion in retail banking.

Particularly in countries with stable regulated markets, nominally competing banks have often been happy to fall into patterns of peaceful coexistence. When American banks have been able to enter such markets, their efficiency advantages have sometimes led to profit levels well above those of their local rivals.[13] On the other hand, U.S. banks have not done very well since being admitted to the Canadian market in 1980. Earlier government restrictions barred foreign banks from establishing subsidiaries, branches, or agencies in Canada, and limited them to a 10 percent holding in a chartered bank. The result was high prices and profits for Canadian banks.[14] Since 1980, foreign banks have been permitted to expand in Canada, but with restrictions—e.g., on the number of branches permitted—that continue to limit their ability to compete with Canadian banks; Citicorp, the largest foreign bank in Canada, has only eight branches. Foreign entrants have been largely denied access to a low-cost deposit base; U.S. banks have not been able to earn the high profits that might be expected in a protected retail market. Nor is Canada the only country in which liberalization has been structured in such a way as to limit the opportunities available to U.S. and other foreign banks.

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[12] See P.L. Zweig, "Some Big Banks Find Entering New Fields A Tough Transition," *Wall Street Journal*, Aug. 13, 1986, p. 1.

Unlike manufacturing companies, financial services firms depend on no raw materials or manufactured inputs to produce their end products. They do depend on people—the bank's employees. In international banking especially, the skills that employees bring to and develop on the job—and the ways in which the organization deploys these people and their skills—can make a great deal of difference for competitiveness. In this, banking is not unlike other knowledge-based service industries.

In recent years, banks have sought greater numbers of specialists in fields like bond trading, currency transactions, and swaps. Increasingly, they have hired in people from graduate schools of business to fill such positions, rather than promoting from lower positions within the bank—O. Bertrand and T. Noyelle, "Changing Technology, Skills and Skill Formation in French, German, Japanese, Swedish and U.S. Financial Service Firms: Preliminary Findings," report to the Center for Educational Research and Innovation of the Organization for Economic Cooperation and Development, August 1986, pp. 47-48.

[13] For example, Citibank has reportedly earned a substantial portion of its worldwide profits in Brazil—20 percent in 1982—where a grandfather exception permitted it to remain after the Brazilian market was closed to other foreign entrants. See I. Walter, "International Competitive Distortions in Banking and Financial Services," draft for Trade Policy Research Centre, London, March 1984, p. 112.

[14] After-tax return on capital to Canadian banks averaged 12.9 percent, compared to 9.1 percent for eight large New York banks—*Efficiency and Regulation: A Study of Deposit Institutions* (Ottawa: Economic Council of Canada, 1975).

Citicorp, Chase, and a few British and Japanese banks have been the only entrants pursuing retail banking on anything approaching worldwide scale. Citi has major efforts underway in Europe and elsewhere, and has been quick to introduce new retail banking products in seeking greater market share. In Britain, Citi's more efficient systems help it process mortgage applications in 10 days, compared with a month for local competitors; Citibank claims to undercut the costs of its rivals by 50 percent in some lines of business.[15] Other U.S. banks have been quite selective in entering retail markets abroad; Citicorp has been alone in expressing interest in acquiring a small Japanese bank as a wedge into Japan's retail market. Citi's strategy is predicated in part on technological superiority leading to lower costs. But to succeed in retail banking, a foreign entrant must also develop a detailed knowledge of local conditions—knowledge at least equal to that of the competition. This is a task that demands a strong commitment over time, even if the new entrant begins by buying an existing bank or hiring experienced people locally. Citicorp gets advantages from being a major commercial lender in many countries. This appears to be one reason it has been able to expand in overseas markets despite being perceived as a foreign presence—a far more serious disadvantage in retail than in commercial banking.

Commercial Lending to Small and Medium-Sized Firms

In recent years, banks both in the United States and overseas have been placing much more emphasis on lending to smaller companies (see, for example, the MetroBank case study in the appendix to ch. 8). Foreign banks in the United States lend to small businesses here; Citicorp's branches in many of the 90-some countries in which it operates are said to be eagerly pursuing the loan business of firms with sales in the $25 million and up range. The reasons begin with securitization, and the increasing self-sufficiency of large corporations. When these corporations go directly to the capital markets, banks may still provide guarantees, and sometimes distribution services, but margins tend to be thin. Smaller companies, less known and perceived to be more risky, still need the services of a bank to raise money.

Financial institutions in different countries have developed this portion of the market differently. In Japan, businesses depended much more heavily on bank loans after the war than on equity. But by the 1970s, as Japanese economic growth continued, larger corporations could finance much of their expansion through reinvested earnings; Toyota, admittedly an extreme case, has generated so much cash the company has sometimes been called the Toyota Bank. As figure 25 shows, the drop in bank lending in Japan compared to other sources of corporate funds has been dramatic. Faced with rapidly declining demand for loans from their major customers, Japanese banks have sought to lend to the small businesses they once ignored.

The Future

Competitive strategy for any commercial bank seeking to expand internationally will hinge on its view of the coupling among its services. Will a bank that offers a broad range of products be able to reduce its costs? Will it reap marketing advantages, perhaps be able to lock-in its clients? Will a corporation that uses Morgan Guaranty as a lead manager in the Eurobond market also borrow money from Morgan domestically? If the answers to these questions turn out to be yes, then banks able to offer a comprehensive package of services will be well-positioned to grow and compete in international markets. By the same token, a bank with an extensive worldwide network of branches,

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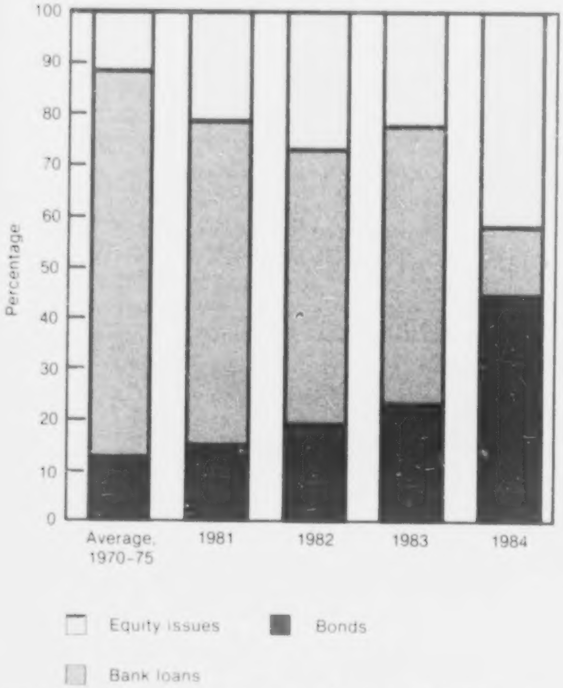
[15] "Citicorp's Gutsy Campaign to Conquer Europe," *Business Week*, July 15, 1985, p. 47. Also see P.L. Zweig, "The Elusive Consumer," *Wall Street Journal*, Sept. 29, 1986, p. 34D. Citicorp has retail banking operations in 34 countries, Chase in 25.

Figure 25.—Sources of External Financing for Japanese Corporations



SOURCE: "Survey of Japanese Financing and Banking," *The Economist*, Dec. 8, 1984, p. 21.

agencies, representative offices, and subsidiaries will be better placed to develop and market a wide range of financial products. On the other hand, no matter the efforts of banks to maintain ongoing "relationships" with clients, customers all over the world seem to be shopping for banking services more extensively than in earlier years. Relationship banking is in part simply a reaction to such trends, including securitization. While some U.S. banks will no doubt have success in locating profitable areas of foreign commercial banking, this is plainly not a strategic route open to all. Those that already have a broad and deep foreign presence —notably Citicorp—seem most likely to prosper through continued penetration of new onshore banking markets.

Furthermore, any strategy aimed at finding and exploiting unusually profitable lines of business depends on doing so before other financial institutions seize the same opportunity. Banking expertise is widespread, particularly in the OECD countries. The history of LDC lending demonstrates the point. Many regional U.S. banks, deciding there were profits to be made in loans to the developing world, set up offices overseas for the first time. Even without the Third World debt crisis, lower returns would have followed simply from the increase in competition. Lending to medium-sized businesses in Canada holds a similar lesson: after the market opened to American banks, fierce competition among Canadian, U.S., and other foreign banks kept profits low. While they lobbied hard and ultimately with some success for greater access to the Canadian market, American banks have been disappointed with the results. They have also won concessions from Japan's Ministry of Finance. This will enable U.S. banks to expand their activities in Japan, but here as well, competition promises to hold down profitability. The point is a general one: in an era of deregulation, profits will be low in many or most of the markets seen as new opportunities for American financial service firms.

Moreover, concessions overseas often go hand in hand with losses of previous advantages. Onshore foreign banks in Japan recently won the right to enter the trust business. The Japanese Government has granted licenses to six U.S. and three other foreign banks. These foreign banks now have a strategic option not open to the biggest Japanese banks. But other recent policy decisions—e.g., permitting Japanese corporations to issue Euroyen bonds—mean that, in at least some cases, Euroyen bonds placed by Japanese banks will supplant Eurodollar bonds that would otherwise have been handled by American banks.

Future competition in international banking promises to be fierce, with many entrants having similar capabilities seeking to establish themselves in new and growing markets (geographic as well as product). American banks do have sources of competitive advantage, primarily their experience in a deregulated and competitive environment, and in applications of technology. Foreign institutions have advantages of their own—e.g., the financial clout of the big Japanese banks—to set against them.

Photo credit: Arthur Lavine, Chase Manhattan Bank N.A.

Currency trading room

JAPANESE COMPETITION: TWO SCENARIOS

Over the past decade, U.S.-based financial institutions have grown rapidly. In terms of assets, however, Japanese banks have grown much faster, as figure 20 showed. The astounding expansion of Japanese manufacturing industries has pulled Japan's financial institutions onto the world scene, with banks following their corporate customers abroad. Although banks from countries like Britain and West Germany are strong in some parts of the market, only the Japanese pose a real threat over the foreseeable future to the U.S. position in financial services.

This section sketches out two possible scenarios for the rivalry between U.S. and Japanese banks. In the first, regulatory constraints and other factors built into the Japanese system slow international expansion, blunting many of the competitive thrusts of Japan's banks. In the second scenario, more rapid deregulation by Japan's Government leads to concerted attacks on international markets by financial institutions largely free to pursue strategies of their own choosing, and with the financial muscle to succeed more often than not. On balance, OTA views the second scenario as more likely, but the critical decisions will be made within the Japanese Government, where they will emerge from the interplay of political and bureaucratic forces. Liberalization in Japan means still more intense competition in international banking, competition to which U.S. and Japanese banks bring differing sets of strengths. At the least, competitive life for U.S. firms will be more difficult.

Constrained Growth

Japan's large continuing current account surpluses have been accompanied by rapid growth in international assets, both financial and nonfinancial. Management of these assets has become the responsibility of Japanese financial institutions, especially the banks, which have grown proportionately. But despite their size, the sense has remained, in some circles, that Japanese banks, while undeniabably major players, have not yet become fully competitive with European and American banks internationally. Some of their rivals do not perceive the Japanese to be good bankers, claiming that they lack the skills and experience that are the strengths of U.S. and European financial firms. Japanese banks, for instance, must compete for the best graduates of the best universities with other industries and with government ministries—a sharp contrast with the United States, where investment banks, especially, can often pick and choose, competing only with one another. All this could change, but in the constrained growth scenario the change will come slowly.

Japan also has a currency that has not been widely used to denominate international transactions. The dollar remains the currency of choice in offshore financial markets, and, to a lesser degree, in trade (box H). To the extent that these patterns continue, American financial services companies have a source of ongoing if modest advantage, while Japanese banks face a competitive hurdle. The Japanese, of course, understand this. Why have they not taken steps to make the yen more acceptable in international business circles? That is, given Japan's presence in world commerce, why hasn't the Euroyen market developed faster? Only in 1986—although the relative asset growth of Japan's banks has been visible for years—did the Ministry of Finance (MOF) permit an offshore Euroyen market in Tokyo.

The reluctance of Japan's Government is understandable. An open door for Japanese financial institutions to participate in international markets, and for the yen to become more widely used, necessarily implies opening Japan's *domestic* financial markets to foreigners. Indeed, this move would have to come first. For the yen to be a major currency internationally, both foreigners and Japanese must have greater freedom to move funds into and out of Japan, to maintain accounts of all kinds, and to otherwise enter Japanese financial markets—as has been the case in dollars in the United States for years.

The MOF, one of the most powerful agencies in the Japanese Government, although slowly loosening its grip on financial and monetary affairs, has no wish (at least in this scenario) to take liberalization nearly as far as it has gone in the United States. Japanese officials view "guidance" of the banking system as one of the critical elements in their country's postwar economic boom. With the postal savings system an important source of financing for Japan's budget deficits and outstanding debt—at interest rates low by world standards—the MOF has little enthusiasm for liberalization, which would raise the cost of servicing that debt. Furthermore, a wholesale loosening would make domestic monetary policy more difficult to implement, and leave the Japanese economy more vulnerable to ill-conceived monetary and fiscal policies elsewhere in the world—a decidedly unpleasant prospect to MOF officials.

Large Japanese corporations see things differently. Regardless of their view of the past, today most would argue that the closed nature of Japanese financial markets limits their strategic opportunities and competitive prospects. Corporations want to control their own financing, without interference from the government. The constrained growth scenario, therefore, hinges on the MOF surrendering its authority only grudgingly, and more often than not prevailing over corporate interests and other government agencies—e.g., the Ministry of International Trade and Industry—that favor liberalization.

Indeed, the MOF appears to be split internally on this issue, with some factions advocating more rapid change. But the interplay of forces within the Japanese Government, and the policies that emerge, will tell only part of the story. Even assuming more freedom for Japan's banks, will they be able to increase their competitive presence as rapidly as Japanese manufacturing firms? Analogies do exist between Japan's growing competitiveness in financial services and past successes in manufacturing. But none of the analogies is particularly close. The constrained growth scenario treats the competitive precedents with skepticism, emphasizing the differences between financial services and the typical Japanese strategy in manufacturing (build scale at home; find attractive market niches overseas; export from a secure base in Japan, seeking greater market share; invest in foreign markets only when forced by political pressures and the threat of trade barriers).

In the constrained growth scenario, two key differences weaken the parallels with Japan's past competitive successes. First, U.S. banks will not easily be outflanked. These are not steel companies, domestically oriented and comfortably ensconced behind barriers created by transportation costs thought high enough to keep out foreign products. Nor automakers, with an international perspective and many foreign investments, but with domestic products perceived as uniquely suited to U.S. market conditions. Nor even computer companies, with technological leads that shrank much faster than expected.

Banking was an international business before Columbus; Japanese banks have been participants for more than a hundred years. For several decades, American financial firms have won out in world markets against able foreign competitors through aggressive strategies and innovative products. Moreover, American banks compete strongly among themselves. Those that survive domestic competition are well-placed to compete internationally. Even more, an increasingly permissive U.S. regulatory environment has taught them how to maintain high levels of customer satisfaction without compromising efficiency. Finally, the U.S. industry benefits from a home market that is the center for new applications of computer hardware and software technologies, as well as telecommunications. Thus, to successfully attack the U.S. banking industry, any competitor must put together a coordinated strategy that can be effective on multiple dimensions (e.g., offshore markets, business lending, retail banking, investment and brokerage activities, applications of new technology). Those accepting the constrained growth scenario see little indication that the Japanese (or anyone else) have the capabilities to succeed in such an endeavor.

There is a second difference. The structure of this industry differs markedly from manufacturing sectors, where Japanese companies could begin by creating efficient production systems to supply domestic markets. When they identified market niches abroad—e.g., small, black-and-white televisions—Japanese firms could export and sell at low prices, taking advantage of their domestic base and local labor force. This is decidedly not the case in a service like banking. To compete, Japanese financial firms must maintain operations in world banking centers such as London and New York. They have to rely on the same labor pool and confront the same cultural traditions as others. They cannot depend on their strength at home, but will have to develop competitive advantages in markets not only far away, but in the backyards of their strongest competitors. This is a new and different competitive environment for the Japanese, one in which success promises to be elusive.

For all of these reasons, then, in the constrained growth scenario, Japanese competition will be slow to develop. Competitive thrusts by Japanese banks will be isolated, with little cumulative effect. U.S. financial service firms will maintain their international leads. The MOF, a conservative force within the Japanese bureaucracy, will not abandon the tools that it believes responsible for a favorable macroeconomic environment. Japanese financial markets will open only slowly. Meanwhile, the U.S. regulatory climate will remain conducive to American success.

Rapidly Mounting Competitiveness

What would it take to invert the picture above? More than anything else, ways in which Japan's banks could turn the enormous increase in Japanese-held financial assets to competitive advantage. Although this overseas asset growth cannot be attributed solely to the efforts of Japanese banks, the fact is that the assets are there, and Japanese banks (and others) have the opportunities (or problems) of managing them.

Not only have the largest Japanese banks grown bigger, more Japanese banks are now powerful enough to be serious players internationally; by some measures, Daiwa, ninth among Japanese banks, is larger than Chase. With expansion come new sources of competitive advantage: Japanese banks can pursue more strategies simultaneously, undertake more activities independently, without the need for correspondent banks or syndicates. Moreover, their asset holdings will continue to grow, at least for the next several years. Although Japan's exports have slowed somewhat, her trade surplus remains large; Japanese financial claims on the world will continue to mount.

Thus far, however, the Japanese approach to their overseas assets has been a conservative one, emphasizing safety. Funds have been held in foreign bank deposits, or invested in Treasury bills and notes, denominated in local currencies. While prudent, such strategies sacrifice many opportunities for greater earnings. A number of signs now point to a more active posture by the Japanese.

Almost any scenario that sees a rapidly expanding Japanese presence in international banking must begin with foreign direct investment in manufacturing. For 30 years, Japanese manufacturers have been very aggressive in seeking out export markets and in guaranteeing their supplies of raw materials (e.g., iron ore) and energy (coal and petroleum). Until recently, most of their other international ventures have been tentative and small in scale. Japanese investments in Western Europe remain a small fraction of U.S. investments there (a cumulative $11 billion, versus $107 billion for the United States).[16] Until the last few years, both business and government in Japan have directed their attention to internal development; electronics and automobile firms, for example, began building plants in the United States only after trade-related political pressures built to very high levels.

Now, of course, the picture is changing rapidly. As pointed out in the preceding chapter, Japanese manufacturing firms have stepped up their foreign investments and begun to establish truly multinational operations. In this, they are following in the footsteps of American firms—footsteps 30 or 40 years old. Just as American firms invested in Europe to assure continued access to markets there, Japanese companies now find themselves seeking to avoid incipient trade restrictions in both Europe and the United States. And, again like American firms before them, Japanese companies now see stronger ties with their foreign customers as a competitive necessity.

Expansion abroad has inescapable consequences for the Japanese financial system, and for the government. Historical parallels suggest that Japanese banks will seek to expand overseas, following on the heels of manufacturing investments. U.S. banks moved abroad to service customers setting up offices and factories around the world. American companies preferred, and still prefer—all else equal—to deal with American financial institutions. But if the banks do not offer their services overseas, companies will find alternatives in foreign banking industries. American banks had little choice but to follow their customers. Japanese banks have the same choice—or lack of choice. They, too, will follow their customers into foreign markets.

But providing familiar services to familiar customers in a foreign setting does not make an international bank, or an international industry; much more is necessary, beginning with accommodating government policies in both home and host countries. In general, favorable host country policies already exist. Japanese manufacturers are moving into markets where other foreign firms—financial firms included—have been comfortable for years. Japanese Government policies, as discussed above, seem a different matter. Indeed, the future policies of the MOF and other Japanese agencies will be perhaps the single most critical factor in determining rates of international expansion by Japanese banks.

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[16] "Japanese Investment in Europe," *Financial Times*, Nov. 13, 1986, sec. III. Department of Commerce estimates placed U.S. foreign direct investment at 41 percent of the world total in 1981, compared to 7 percent for Japan. *International Direct Investment: Global Trends and the U.S. Role* (Washington, DC: Department of Commerce, 1984), p. 45.

With trade friction and political pressure mounting on many fronts, financial liberalization is but one of a series of policy questions facing Japan's Government. For years, other countries have objected to export-led growth in Japan, and demanded reciprocal access to markets there. Beyond this, other countries have begun pressing the Japanese to behave more like a major world power. Japan's corporations, meanwhile, face stronger competition in their traditional export markets from developing countries—South Korea, Taiwan, even Brazil. With Japanese manufacturers responding to new pressures in part through rapid increases in foreign investment, financial institutions, by every indication, wish to become more active not just in financing for Japanese corporations, but in the entire range of banking services supplied internationally. Both manufacturing and banking sectors will press their views on the Japanese Government—arguing that financial liberalization is necessary, and must come quickly. The real questions, then, concern the government's response.

As yet, the MOF has not been willing to move very far on domestic matters—a precondition for international expansion, for reasons outlined above. Still, many signs in both official reports and in the Japanese press indicate that the Ministry will not try to stall liberalization indefinitely. MOF officials, like their counterparts elsewhere in the government, have many times acknowledged—to be sure, in vague and noncommittal ways—the need for Japan to take its rightful place among the world's economic powers.[17] Given changing attitudes elsewhere in Japan's Government (and in some parts of the MOF), it is a reasonable presumption that, although the Ministry may be able to fight a rear guard action, ultimately it will have to give way. In this second scenario, the MOF gives way sooner rather than later.

The major Japanese banks, foreseeing the eventual outcome on the policy front, clearly plan to be ready; they are attempting to gain experience, as quickly as possible, in the somewhat arcane ways of international banking. They still have a good deal to learn. Will Japanese banks be able to establish foreign branches and subsidiaries that can compete head-to-head with long-established and aggressive rivals? On such matters, the jury will be out for a number of years. But few today would underestimate the ability of Japanese firms in *any* industry to master the intricacies of international competition. And of course, the banks will not be alone. With the new foreign investments by Japanese manufacturing firms, Japanese financial institutions have a ready-made customer base, solid ground on which to build.

This leaves, finally, the question of whether the world will continue to rely on the U.S. dollar. The answer, in this scenario, is that it makes little real difference. The primacy of the dollar is not all that important for American financial firms. Non-U.S. banks compete effectively in offshore dollar markets already. Indeed, banks from quite a large number of countries compete successfully in whatever markets they choose to enter, even if they cannot manage a presence across the board. Beyond this, the dollar will not necessarily retain its dominance over the longer run. Other currencies—notably the yen—could make inroads. This would, once again, require policy changes in Japan, but Japanese economic strength makes growing prominence for the yen inevitable.

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[17] For example, "International Banking's Pending Issues Suddenly Unfold," *Japan Report*, Joint Publications Research Service JPRS-JAR-86-018, Dec. 19, 1986, p. 58—an interview with Takotomo Otsu, International Finance Bureau, Ministry of Finance, translated from *Ginko Jihyo*, Sept. 16, 1986.

In this scenario, then, Japanese competitiveness in international financial markets steadily increases. Japan's Government raises its profile internationally, making clear its intent to protect the interests of Japanese banks should an international debt crisis arise. Major U.S. banks, vulnerable because of their exposures in the developing world, find the competitive balance tilting toward the largest holders of international deposits in the world.

It is too early to predict outcomes. But competition between the United States and Japan in financial services will certainly intensify. The competition will differ in many ways from that in manufacturing industries, but past experience suggests that it would be better for U.S. bankers and U.S. policymakers to err on the side of overestimating rather than underestimating the Japanese threat. Policymakers in the U.S. Government tempted to urge their Japanese counterparts to liberalize rapidly might first think through the full range of possible consequences.

POLICY ISSUES

Governments everywhere regulate banking; in some places they own the banks. Rules set by governments determine the products offered, and, indirectly, the profits that are possible. Banking is a very special industry. Banks provide the mechanisms for creating, transferring, and storing money—essential for the exchange of goods and services. All industrial market economies have relatively complex and sophisticated banking systems. Banks are also special because of their role as depositories of savings and other financial assets. All governments take steps to protect consumer deposits. Finally, governments implement monetary policy through the banking system—in the United States, a process centering on the Federal Reserve Board (FRB). The special nature of banking means deregulation—permitting banks and bank-like firms to respond more directly to market incentives—will not go too far. Deregulation tempts banks into riskier lines of business. But customer safety, and public perceptions of safety, will keep governments involved in the banking industry, just as governments will continue to regulate some aspects of the airline industry.

Given the special relationship between government and the banking system, should Federal agencies support U.S. banks internationally? If so, when and how? Or should the primary concern of policymakers be domestic financial services? In reality, such distinctions are false. As the scenarios for Japanese competition suggested, competitive ability depends in part on domestic policies—a fact of life in this and many other industries, although one that the U.S. Government has seldom acted on, or even acknowledged.

Domestic Regulations

Separation of Commercial and Investment Banking

Although administrative and judicial decisions have widened the scope of activities permitted commercial banks, and the bank-like businesses that compete with them, the Glass-Steagall Act and other U.S. laws and regulations continue to enforce a separation between investment and commercial banking. Few other countries divorce these two activities.

The argument for following much of the rest of world in permitting universal banking begins with the steadily increasing integration of national capital markets, and the growth of hybrid products such as floating rate notes that combine features of commercial and investment banking services. With securitization, investment banking products tend to replace commercial banking products. To be competitive in investment banking, moreover, now demands large amounts of capital—capital that U.S. commercial banks have, and U.S. investment banks need. Mergers and acquisitions involving U.S. investment banks—including the recent purchase by Sumitomo of a share in Goldman

Sachs—have been driven by these requirements for capital. Finally, say the advocates of relaxation, the view that combining commercial and investment banking leads to potential conflicts of interest—the original reasoning behind Glass-Steagall—is no longer true, if it ever was (as shown in part by the lack of such problems in universal banking in Europe).[18]

The case for maintaining the separation with little or no change rests on a different logic. Removing the restrictions would work to the benefit of large commercial banks—many of which have made major errors in judgment in recent years. The implication? Relaxing Glass-Steagall and other restrictive policies might simply give big banks more room to make big mistakes, perhaps requiring new government interventions to resolve.

Whether one likes it or not, however, the walls between commercial and investment banking are crumbling. Policymakers must first ask, given continuing efforts by commercial banks to expand into these activities, whether it will be possible to continue enforcing the separation indefinitely. After all, commercial banks seek to move into investment banking in part to counter the thrusts of other financial and non-financial firms into their own territory—thrusts made possible by deregulation in the United States over the past decade.

In a climate of contagious deregulation, can the barriers between commercial and investment banking hold? OTA's analysis suggests that, in the long run, they cannot. The analysis also suggests that the regulatory separation has had only limited significance for the international competitiveness of the U.S. financial services industry (helping in some ways, hurting in others)—but that a policy of attempting to preserve the separation indefinitely could be inefficient if not counterproductive.

U.S. banks will continue expending effort and resources in finding ways to circumvent the rules—effort that might better be directed elsewhere. The questions then become: When and how should the rules be relaxed? Should policymakers permit gradual and selective entry by commercial banks into some but not all currently prohibited businesses? Or should the prohibitions simply be dropped at some agreed time? It may be time for Congress to confront these issues more directly.

Regulation of Interstate Banking

The other major division imposed on the banking industry by U.S. legislation, in the form of the McFadden Act, together with subsequent laws restricting bank holding companies, has been geographic: banks were not to expand across State lines. Here, judicial rulings, legislative changes, and technological developments have combined to undermine many of the prohibitions written into the law, as these affect wholesale and international banking.

Indeed, at this point, permitting unlimited interstate banking would make little difference for the international postures of U.S. banks, with one exception. In several parts of the United States, existing small to medium-sized banks have begun to merge into super-regional firms—often taking advantage of legal provisions that favor their expansion over existing money-center banks. Although few do much overseas business currently, some will probably grow large enough to support operations in, say, London—in doing so, recapturing customers lost to correspondent and money-center banks. (NCNB, of North Carolina, is one of only six U.S. banks with membership on the London Stock Exchange.)

While the emergence of these super-regional banks will take time, they could eventually provide a source of new vitality, helping the U.S. industry maintain its competitive position. In sum, there seems little reason based on *international* considerations for Congress to consider changes in the laws governing interstate banking.

The Banking Infrastructure

The FRB, along with agencies such as the FDIC, maintains a dual relationship with the

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[18] For the historical background, see I. Walter, *Barriers to Trade in Banking and Financial Services* (London: Trade Policy Research Centre, 1985).

U.S. banking system. On the one hand, as a regulator, the Board sets rules under which banks must operate. On the other hand, the FRB also supplies banking services—notably clearing and settlement for member banks, a critical part of the Nation's banking infrastructure. How well government agencies fulfill their functions as instrinsic parts of the banking system helps to determine the competitive position of the U.S. industry.

When a Korean firm borrows dollars, the transfer of funds from the lender's account to that of the borrower normally takes place through the CHIPS system, while the net settlement between banks involves FedWire (box G). FedWire, CHIPS, and the other elements in an efficient transfer system have played key roles in maintaining the dominant position of the dollar in world commerce. By legislation, the FRB's FedWire system is to be a break-even service.[19] In recent years, the Board, in its role as regulator and provider of net settlement services, has acted in ways that insulate FedWire from competition. For instance, the Fed has imposed caps on daylight overdrafts regardless of whether the overdrafts are on FedWire or a competing service. Banks, needing to carefully monitor their overdrafts, have tended to give more of their business to FedWire, at the expense of private competitors.[20] Fewer rivals for FedWire could mean less pressure to keep prices low and reliability high—the principal issue for policymakers.

The possibility of conflicts between the Fed's concern for its own profitability and its regulatory responsibilities will exist so long as the FRB acts both as competitor and regulator; given the importance of FedWire and other portions of the banking infrastructure for the Nation's competitive position, maintaining the efficiency of this infrastructure becomes an ongoing policy issue of some significance. If anything, the Monetary Control Act of 1980, which requires the Fed to cover its costs, may encourage the Board to use its regulatory power to reduce competition, and, with it, the efficiency of the payments process.

Safety and Stability of the Financial System

Like the Fed, the FDIC provides services to the U.S. banking industry—deposit insurance, for which banks pay an annual premium—while also functioning as a regulatory body. In practice, the FDIC may act to protect all deposits, even those in overseas branches, given its overriding concern with preventing bank failures in the first place. The FDIC's policy of protecting banks in order to protect depositors means that new financial products may, like overseas deposits, get the benefits of the FDIC umbrella even though in principle outside its coverage (and even though no premiums are paid). Standby letters of credit, for example, create contingent liabilities for the bank. If the borrower fails, the liability becomes a real one. A deposit insurance program that prevents bank failures has the effect of insuring SLCs as well, even though the FDIC's legal obligations may not extend this far (a question at present unanswered).

SLCs are only one of many examples where the FDIC's nominally domestic guarantees can affect international competition. But it would be wrong to suggest that FDIC protection creates major competitive advantages for U.S.-owned banks. Other industrialized countries are no more likely to let their large banks fail than is the United States. The issues revolve around the implicit subsidies provided by such guarantees.

Governments everywhere stand behind their financial systems. In doing so, they help their banks compete. Unless governments collect fees or premiums reflecting the risk of failure, they are subsidizing these banks. Subsidies may well be justified, considering the benefits to the public at large, but they nonetheless raise the question of distortions internationally. Movement toward standardizing practices across countries—e.g., tying premiums to the protection actually provided, thus reducing subsidy levels, or reducing uncertainty as to the immediacy of payment in the event of a failure—would be a significant step toward a level playing field. Another step would be to pursue international agreements aimed at coordinating regulatory and supervisory practices, thereby reducing the need for either implicit or explicit insurance. Put another way, international coordination of regulatory practices can reduce the potential for distortions in financial markets. International agreements aimed at standardizing such practices, although they might take years to achieve, merit high priority as a U.S. negotiating objective (see below and also ch. 10).

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[19] In 1984, the Board reported that FedWire had become largely self-supporting, and that its wire transfer services as a whole had made a $3.5 million profit. *Seventy-first Annual Report, Board of Governors of the Federal Reserve Board* (Washington, DC: Federal Reserve Board, 1985), p. 194.

[20] See J.W.H. Watson, "Fed Drives Out Competitors in Bank Fund Transfers," *Wall Street Journal*, Mar. 13, 1986, p. 30. Bankwire, founded in 1952, and by 1971 jointly owned by some 200 U.S. banks, ceased operations in Febuary 1986.

Problem loans to developing countries raise similar issues. Some of these loans pose potential threats to the solvency of large U.S. banks. How far should the Federal Government go toward lessening these threats? The Baker Plan—a U.S. initiative proposed by Treasury Secretary James Baker, calling for joint action by the banks, the borrowing countries, and multinational lending institutions (e.g., the World Bank)—would help the borrowing countries service their debt, thereby reducing risks for the banks. But perhaps more effective government policies could have kept the banks out of the trouble they're now in. LDC loans also raise the question of coordinating policies toward loss reserve requirements—currently stricter in the United States than in Japan, for example.

Given the trends outlined in this chapter, policymakers may wish to consider risk-related insurance premiums as an alternative to other forms of regulatory interventions in the financial services industry. The Third World debt situation provides perhaps the strongest argument for such an approach. The problem, of course, lies in making the judgments about riskiness, particularly for new or different ventures. Still, that is what insurance is all about.

Does the United States Need a New Approach to Banking Regulations?

The U.S. deposit insurance system, the regulatory separation between investment and commercial banking, and restrictions on interstate banking all stem from legislation passed in the aftermath of the banking collapse of the 1930s. The laws have been modified over the years, but with no fundamental shift in philosophy. In the practice of banking, however, change has been sweeping--both internationally and domestically (e.g., the rise of non-bank banks). Perhaps it is time for Congress to consider comprehensive new banking legislation.

Reasons for considering a new approach begin with interactions between spheres of regulatory and supervisory practice once largely independent, but no longer so. For example, lifting the Glass-Steagall restrictions would force changes in FDIC insurance; otherwise, the insurance umbrella would, in effect, be stretched over a wide range of risky activities for which it was never intended. Banks with FDIC coverage would be competing with uninsured non-banks, who could legitimately protest unfair competition. One alternative would be to switch the basis for regulation from an institutional focus (i.e., regulating what a particular type of institution can do) to functional regulation. Commercial banks might then be permitted activities currently denied them under Glass-Steagall (and other current laws), but in turn directed to treat funds from different sources differently. For example, individual depositors could be protected by requiring banks (and non-banks) to invest funds from small depositors only in short-term Treasury securities, and to give such depositors priority in the event of a voluntary or involuntary liquidation—thereby reducing or eliminating the need for insurance to protect consumers.

Future Policies; Negotiating Objectives

Data for Analysis

The Federal Government collects a great deal of data on international banking compared with other service industries; unfortunately, none of it measures international banking activity in ways that correspond to exports and imports in other industries.[21] Because existing data can offer little guidance for policymakers on probable consequences of changes in either foreign or domestic policies, banking and other financial services deserve high priority in any effort to improve data collection and analysis relating to trade in services. In the absence of such information, policymakers might, in fact, wish to deemphasize liberalization of trade in financial services simply because the consequences for the U.S. economy cannot be predicted.

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[21] *Trade in Services: Exports and Foreign Revenues* (Washington, DC: Office of Technology Assessment, September 1986). The

Dealing With Restrictions Abroad

U.S. financial services firms face severe restrictions in many foreign countries.[22] Some governments simply deny entry to foreign banks, or limit the businesses they can pursue; until recently, Sweden prohibited any foreign bank office from accepting deposits or making loans. Some countries deny foreign-owned banks full access to the central bank discount window; foreign banks must often use clearing systems controlled by their local competitors.

There are cases in which U.S. banks can engage in activities denied to local banks. Until the early 1980s, only foreign banks in Japan could make foreign currency loans to Japanese borrowers—a lucrative business. Opening the market to Japanese banks has hurt the onshore firms. But in general, foreign government policies limit U.S. banks compared to their local rivals, with restrictions on the type of foreign presence—branches, subsidiaries, agencies—making it difficult for U.S. banks to operate as integrated multinationals. Australia, Canada, Finland, New Zealand, Norway, and Sweden, among others, permit foreign banks to establish subsidiaries but not branches. This imposes more of an arms-length relationship than other organizational forms. Some countries limit transfers of funds across their borders. Negotiations that would help American banks integrate their worldwide operations deserve high priority.

Unfortunately, the 1978 International Banking Act removes a potential lever for U.S. negotiators. So long as the law is in place, the United States cannot really threaten to reciprocate when other countries place burdensome restrictions on U.S.-owned institutions. A credible threat of reciprocity in banking regulations, even if never called upon in practice, could be a negotiating advantage for the United States. Congress may wish to consider amending the International Banking Act to this effect.

International Coordination

Each country has its own banking regulations, with many differences. South Korean companies seeking to expand have a difficult time raising money in part because of restrictions on Korean banks. And if a Korean bank tries to float bonds in the United States for a Korean corporation, it will face restrictions that limit the foreign portfolio holdings of American purchasers. For such reasons, the Korean company will more than likely go to the Euromarket, where neither Korean nor U.S. regulations apply. Similarly, a multinational corporation will do business with banks wherever it can make the best deal. U.S.-based MNCs will borrow from European or Japanese banks if lower capital ratio requirements permit better terms than American banks can offer. European banks and governments, meanwhile, argue that their tighter supervision of off-balance-sheet activities handicaps them unfairly in markets for, say, floating rate notes.

The dilemma is plain. Asymmetries in regulations induce banks to move their operations elsewhere—e.g., to offshore markets. If national governments maintain their regulations unchanged, their domestic banking industries lose business and their regulatory agencies lose con-

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(continued from previous page)

special problems posed by measuring trade in financial services are summarized on p. 40, with OTA's own estimates for foreign revenues in commercial banking on pp. 56-58. These estimates suggest that the foreign revenues (not exports) of U.S. banks probably exceeded $12 billion in 1984, but the underlying data are too weak to place a great deal of confidence in this or any figure.

[22] For details, see "National Treatment Study: Report to Congress on Foreign Government Treatment of U.S. Commercial Banking and Securities Organizations, 1986 Update," Department of the Treasury, Washington, DC, December 1986. Also: earlier Treasury Department national treatment studies (in 1979 and 1984); *International Trade in Services: Banking* (Paris: Organization for Economic Cooperation and Development, 1984); and "Direct Sources of Competitiveness in Banking Services," prepared for OTA by J.G. Kallberg and A. Saunders under contract No. 533-5640, pp. 5.5-5.47.

trol. They can either try to extend their regulatory grasp to the offshore market or liberalize domestically. Offshore markets cannot be unilaterally regulated, but U.S. policymakers have nonetheless sought at times to have it both ways. The FRB's decision in 1981 to permit U.S. and foreign banks to establish international banking facilities (IBFs) in the United States represents an attempt to compete with offshore markets by permitting lightly regulated Eurodollar-like markets here. But in part because IBFs still must live with more regulations than competing offshore establishments, growth has been slow. Attracting more of this business to the United States would mean relaxing regulations that the FRB considers important for the stability of the U.S. banking system.

Where banks and their customers meet in international capital markets, then, banks will press their governments for treatment at least as lenient as their foreign rivals, or seek agreements that will impose tighter standards on those rivals. U.S. banks argue for higher capital ratios elsewhere or lower ones in the United States. But the function of such regulations is to preserve stability—an objective difficult to question so long as regulations do not unnecessarily sap efficiency. All this suggests that, difficult as it may be to achieve, international coordination of policies toward banking should be a paramount goal—that this is one industry where the hoary notion of a level playing field has real meaning as a policy objective; there is no reason to permit large financial institutions or large MNCs to play off governments—each with good reasons for regulating financial services—against one another.

U.S. policymakers will need to continue balancing the need for safety and stability in the Nation's banking system—and the ability to pursue monetary policy—against the benefits of a more liberal and presumably more efficient banking system worldwide. Policymakers may also find it time to begin considering whether to move beyond coordinated national policies toward supranational supervision and regulation of financial services.

CONCLUDING REMARKS

International banking has grown very rapidly in the postwar period. U.S. financial services firms have been pre-eminent over much of this time, although banks from other countries have often grown faster. These strides by foreign banks do not mean that the competitive abilities of American financial institutions have diminished so much as that other economies have been expanding rapidly, and their banking industries becoming stronger.

Banks compete not only with one another, but with their customers. Businesses turn to banks for financing needs ranging from cash management and short-term revolving credit to the structuring of complex financial packages for capital expansion and overseas investment. Large corporations need financial institutions relatively less than smaller companies. Multinationals have the capability to manage their own cash and market their own commercial paper, although they may need banks for access to the clearing system or for insuring their paper. As a corporation's own cash management system improves, its banks must maintain an edge or lose business; if the banks get better, the corporate treasury operation will too.

Electronic cash management is possible only because of developments in computer and communications systems; data processing and telecommunications technologies help integrate world capital markets, make new banking products possible, and provide faster and cheaper delivery of traditional banking services. As electronic messages have replaced paper and the telephone, the amount of information available to bankers making decisions on loans or currency transactions has increased enormously.

Innovations in financial products and in the technology for delivering services have helped American banks maintain their competitive positions. U.S.-based institutions have dominated in markets for new products such as interest rate swaps and Eurobonds. They have adapted rapidly to securitization; when it comes to technologies used in trading securities, American firms lead the rest of the world by substantial margins. In many markets, U.S. banks have been successful despite inherent disadvantages; examples include banker's acceptances for third-party trade, and securities underwriting in foreign currencies.

At the same time, foreign banks have dramatically increased their presence in the United States (although expansion has slowed in the last several years). Does this imply lagging competitiveness by U.S. banks in their home market? OTA has found little evidence to suggest such an interpretation; foreign banks come here in part to gain experience in a highly competitive, deregulated, and technologically advanced industry; the very fact that U.S. financial services firms remain highly competitive internationally attracts foreign banks seeking to learn from U.S. experience. As in other industries, the size and wealth of the Nation's economy attracts foreign firms.

Many of the forces that have worked to the advantage of U.S. competitiveness in the past promise to continue to do so. But competitive patterns can and will change. Americans—both as individuals and as corporate officers—may think first of Merrill Lynch or Chase Manhattan when it comes to financial services, whether domestic or international. Japanese feel the same way about Nomura Securities and Fuji Bank. Nonetheless, U.S. automakers, who once bought all their steel from American steelmakers, now purchase overseas as well. Today, American corporations increasingly seek financing on the world market.

Competition among the world's major banks has tended to keep differences in the price and characteristics of services relatively small. Still, banks differ in corporate strategy, in marketing skills, in production efficiency. Seldom are these differences large enough to enable banks from one country to quickly or easily take business from foreign rivals who have comfortable working relationships with major customers. Over time, they do have a cumulative impact on market share and other indicators of competitive success.

But the financial institutions in the advanced industrial economies will probably not diverge very much in terms of the factors that determine competitive outcomes. Market forces will keep them close together (in the absence of massive changes in the world economy). Innovations in banking products and in back-office production technologies diffuse with considerable speed. Other governments are following the U.S. lead in deregulating financial markets. Both forces—technology and deregulation—point toward increasing convergence. If anything, the competition that already exists in the United States and in offshore markets—and the multinational character of U.S. banks—will give them ongoing opportunities to attract customers based in foreign countries. American banks that take advantage of these opportunities should continue to do well internationally.

The forces at work in financial services will also lead to greater cross-penetration of major markets, both domestically (in the form of regional and perhaps nationwide banking) and internationally. Moves by banks like Citicorp and Chase into regional U.S. markets find their analogs in competition in Tokyo and London, as well as New York, among banks and securities houses from many countries. British banks are moving in the same directions as American banks—and for many of the same reasons. The deregulation of the London stock exchange, the Big Bang of October 1986, will surely speed the convergence of financial services offered by U.S. and British firms (although London is currently behind in technology).

Deregulation in Japan has been slower, with Japanese banks less willing than their American counterparts to test the limits of existing laws and regulations. Even so, banks in Japan have been pushing for greater freedom of action for some time. In 1979, for example, arguing that restrictions on managing issues overseas only applied to public offerings, the wholly owned Swiss subsidiary of Fuji Bank took the lead role in managing a Swiss franc private issue for a Japanese construction company. These and subsequent thrusts by Fuji and other Japanese banks led to the de facto reinterpretation of parts of Section 65 of the Japan's Securities and Exchange Law, which controls the separation of commercial and investment banking in Japan.[23]

Internationally, with so many players in each market, price competition will continue to be intense. Customers will be able to switch easily among competing banks; the banks will be under constant pressure to hold down prices. Real or threatened competition will keep margins low, making financial services unprofitable by the standards of the late 1970s—not only in major world markets, but in many markets previously viewed as local or regional. In this competitive milieu, the leading banks from each country may well change. The big banks in the major industrial countries will be carrying the burdens of past mistakes for years to come; loan portfolios weighted down with Third World debt limit their strategic options. Emerging super-regional banks in the United States, with stronger balance sheets, may be able to take international business away from larger banks that must avoid new risks. At the same time, regional banks—in the United States, Japan, and elsewhere—will face much stronger competition in their traditional markets. As a result, the high profit levels of regional and super-regional banks will probably diminish.

Governments affect competitive dynamics in this industry through regulatory and supervisory policies, directly and indirectly. All governments view banking as a special industry. In seeking to protect depositors, particularly individuals (and for political reasons), they inevitably have an interest in the fortunes of individual banks. But national regulations have become increasingly difficult to maintain; when one country deregulates, others may have little choice but to follow. With national regulatory structures growing more porous, real dangers of instability on a global scale follow. Given ongoing integration in world financial markets, it may be time to seriously consider supranational regulation of those markets.

Governments not only regulate, some own and operate financial institutions. While postal savings banks, for example, may have no direct presence internationally, they can nonetheless affect competitiveness indirectly. Japan's postal savings system—the largest depository institution in the world—makes the Japanese Government cooler than it might otherwise be toward liberalization. By increasing competition for deposits—and, in effect, giving Japanese savers access to the higher market interest rates set internationally—liberalization would force the postal savings system to pay out more in interest.

As Japanese manufacturing firms continue to invest in other countries, Japanese banks will follow. As they do, they will mount more substantial and more sophisticated competitive challenges to the leading American financial firms, in this aided by Japan's very large holdings of foreign assets—a legacy of many years of trade surpluses. At this point, many of the decisions that will determine the pace and force of this challenge remain matters of domestic Japanese politics: if those advocating rapid change in Japan's own financial markets win, further penetration of Japanese banks into international financial markets will come quickly; if the conservative Ministry of Finance manages to hold onto most of its control over Japan's domestic markets, the pace will be slower.

What then of the outlook for U.S. financial service firms? Deregulation and new competition will, as always, make for winners and losers. Some foreign banks may continue growing faster than American banks, if only because they service faster-growing economies. Japanese firms like Nomura Securities will continue expanding in the United States to serve Japanese (and American) clients. Leading U.S. institutions will report profits below traditional levels, some of the super-regional banks will flounder, some large banks may shrink dramatically. Mergers, possibly involving some of the biggest banks—U.S., Japanese, European—will continue.

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[23] E.W. Hayden, "Internationalizing Japan's Financial System," *Japan's Economy: Coping With Change in the International Environment*, D.I. Okimoto (ed.) (Boulder, CO: Westview Special Studies Series, 1982), pp. 99-100.

By several measures, particularly in terms of asset size, U.S. banks have lost ground in recent years. Given the ongoing shift in international banking from lending to fee-based services, these losses—and the gains by Japanese banks—are not so serious as they would otherwise be. But a major competitive challenge to the American financial services industry is coming from the Japanese. The outcomes may be in doubt, but not the gravity of the threat to U.S. competitiveness.

Chapter 4

International Competition in Engineering and Construction

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Chapter 4

International Competition in Engineering and Construction

SUMMARY

Through the mid-1970s, American engineering and construction (E&C) firms won far more international contracts than competitors from other countries. For many of the larger U.S.-based contractors—Bechtel, Brown & Root, Fluor—international projects came to account for half or more of revenues and profits. But as international construction boomed and U.S. firms did well, others did better. U.S. market share gradually slipped.

The 1980s brought a new era to the world construction industry. Like so many of their counterparts in U.S. manufacturing industries, American E&C firms found themselves in a world with many more quite able competitors. A second factor accelerated the slide in U.S. market share: declining economic growth rates in the Third World, plus the collapse of oil prices, meant fewer international projects.

Over the past two decades, the E&C firms of the less developed and newly industrializing countries (LDCs and NICs) have matured. Meanwhile, the Europeans and Japanese pursued strategies based largely on the development of technological advantages, first in construction methods needed to deal with conditions in their home markets. So long as Third World growth was strong, and Middle East oil revenues high, there were enough international contracts to keep many companies busy. U.S. market share gradually fell, but for practical purposes American companies had all the business they could handle.

Today, deteriorating economic conditions mean fewer of the big construction jobs—dams and water projects, airports and electric generating plants—that have been a staple of U.S. (and European) E&C firms. Third World debt burdens mean that developing countries cannot afford new projects. Falling oil prices have cut sharply into new construction in the Middle East and other oil-exporting regions. The oil-exporting nations already face overcapacities in petrochemical production; they have neither the money nor the need of earlier years. At the same time, these countries can now handle many projects on their own that a decade ago would have been contracted to a foreign E&C company.

Moreover, contractors from NICs including South Korea, Brazil, and Turkey have begun to compete against firms from the developed nations in the international market. With the NICs pushing from below, E&C firms from the other developed countries have invaded markets once the province of American contractors, often with the aid of subsidized financing packages put together with government help. Companies based in Britain, France, and West Germany—major players in the international construction game for many years—have been joined by aggressive competitors from Japan, Italy, and elsewhere.

Three primary factors affect international competitiveness in the E&C industry: costs, financing, and technical capability—the latter including managerial expertise as well as engineering skill. Generally uncompetitive in labor-intensive construction, American companies have concentrated on the professional services portion of the industry—architecture, engineering, construction management, and operations and maintenance. But with rising competence elsewhere, U.S.-based firms have had trouble competing on a cost basis even for the more sophisticated jobs; despite hiring growing numbers of foreign nationals for work on international projects—engineers and supervisors, as well as people in lower skilled positions—American companies continue to lose contracts to foreign competitors with lower costs overall.

With more competition for fewer projects, U.S.-based firms will increasingly find themselves members of international consortia. To survive internationally, they must rely more than ever on strengths in putting together financing packages, and on their managerial and technological expertise. The alternatives? Withdraw from the market, or operate internationally only in protected segments created by U.S. Government set-asides (e.g., military projects). With other governments participating in financing—to support exports of materials and equipment as much as E&C services—American companies have been actively seeking joint ventures with foreign partners, in part to tap the financial resources of the latter. This pattern will probably continue even if U.S. efforts to wean other countries away from subsidized financing succeed.

The picture is not all grim. American companies still have excellent and deserved reputations in engineering and project management. If not, as they once were, broadly superior, U.S. firms lead the world in technologies such as computer-aided design and drafting (CADD), and in know-how for designing petroleum refineries and some kinds of power stations and chemical plants. They also retain a lead in managerial expertise—which remains a significant though diminishing source of advantage, given the shift in the market away from massive projects demanding skills in logistics and coordination on jobs involving hundreds of subcontractors and suppliers. Even so, management tools such as computerized inventory control systems and scheduling methods can help cut costs and increase productivity on projects of all sizes, as can advances in construction technologies such as automated earthmoving equipment and pipe bending machines. These technologies can help to reduce the labor cost disadvantages of U.S. construction firms, as can techniques for offsite fabrication of major components and designs that are easier and cheaper to construct.

Taken together, advances in construction technology will, over the next two or three decades, lead to huge increases in productivity. Currently, however, it is foreign companies, not American, that have the lead in fields like tunneling, reinforced concrete construction, and some applications of new materials. Overseas firms—especially the Japanese—do much more research on basic construction processes. Most U.S. R&D has been directed at managerial and design technologies, and at industrial process engineering. While American E&C firms have been seeking to position themselves to take advantage of growth in emerging industries like biotechnology, the common strategy—serving as a broker who can put together a turn-key package of process technology for the customer —today can compensate only partially for lack of a proprietary technological position in the sense of firm-specific know-how.

American companies have begun to adapt to new competitive realities, somewhat hesitantly. The years ahead promise further painful adjustments. Broadly speaking, loss of competitiveness in engineering and construction has implications for the entire economy. Even though only a small portion of U.S. E&C firms seek international business, and even though the linkages between exports of E&C services and exports of goods have been weaker in the United States than in other nations, loss of competitiveness in the E&C industry translates into reductions in the export potential of industries that sell capital goods internationally. These range from computer systems for air traffic or industrial process control, to steam generating units and turbo-alternators, to mining, earthmoving, and construction equipment itself.

Furthermore, as E&C markets have dried up elsewhere, foreign firms have turned their attention to the United States. Using skills honed abroad, some of these companies have begun to make substantial inroads into the huge domestic U.S. construction market; American E&C firms could begin to find themselves uncompetitive at home as well as overseas.

The most immediate government policy impacts in this industry come through financing. Progress in matching or eliminating foreign government subsidies—e.g., mixed credits—would be a real help to U.S. firms internationally, not only in winning contracts they might otherwise lose, but in permitting them to avoid some of the joint ventures with foreign partners they have been forced into. Beyond this, Federal support for R&D that underlies the E&C industry—including new applications of existing technologies, and diffusion of results—could help American companies rebuild their technical prowess. Even in the absence of foreign government subsidies, American firms will need better technology over the medium and longer term to compete. The evolutionary transformation of construction into a high-technology industry, already underway, means new opportunities for American firms that can innovate and establish strong technological positions. While Federal procurements could help the industry, an aggressive strategy based on strengthening the infrastructure for technology development offers the best hope for maintaining competitiveness over the longer run.

INDUSTRY STRUCTURE AND TRADE

Some firms do business in both the design and construction portions of the industry, others specialize in one or the other. Box I includes examples of typical projects of both types, drawn from recent or current international projects won by American firms. *Design* activities, encompassing both architecture and engineering, include:

- project feasibility studies, ranging from economic analyses to environmental impact assessments;
- conceptual design, for appearance as well as function;
- cost estimating;
- engineering, including site planning, structural analysis and design (foundations, calculations of loads and strength), and—for buildings—heating, ventilating, and air-conditioning, as well as other building systems (e.g., electrical power); and
- preparation of detailed drawings and specifications to guide construction.

The *construction* phase involves procurement and tracking of materials and supplies, mobilization of labor and equipment, site preparation, earthmoving, onsite materials handing, and fabrication and erection. Contractor and purchaser may each have their own inspection and quality control personnel. Development of operations and maintenance (O&M) procedures, and training of the client's work force—while not normally considered part of the E&C industry—fits logically as a part of the engineering process; moreover, a number of E&C firms now undertake ongoing O&M work on a contract basis.

Many E&C firms specialize in certain types of projects—Fluor in energy-related work and petrochemicals, Ebasco in power generation. Other firms specialize by technical function—T. Y. Lin in structural engineering, Louis Berger International in planning, design, and construction management. Some companies choose to diversify, and compete for many types of jobs. Even so, a company that builds, say, communications networks would seldom be found putting up residential buildings.

Contract opportunities typically emerge at four stages during large international projects: feasibility studies; design and engineering; construction; and startup, including O&M training. The earlier an E&C firm becomes involved, the better the chances of further contracts. As a rule-of-thumb, feasibility studies account for about 1 percent of the eventual project cost, with design and engineering about 10 percent. Construction management can run between 2 and 6 percent of total costs, while lifetime expenses for operations and maintenance may amount to several times the design and construction cost, depending on the type of facility. E&C firms may make little if any profit on feasibility studies—indeed, because they provide an opening wedge for future design and engineering contracts, may treat them as loss leaders.

Box I—Examples of International Design and Construction Projects of American Firms

- The Guy F. Atkinson Construction Co. leads an international consortium that is building the Guri Dam in Venezuela, the second largest hydroelectric development in the world. With the firm Eulogio Grodo y Cia, Atkinson is also responsible for the Colburn Dam in Chile, which will be that country's largest.
- A group of U.S. firms helped build the 1.8 million square foot Taipei World Trade Center in Taiwan. Bechtel International served as consultant for construction supervision and project management, Hellmuth, Obata & Kassabaum as lead architect, T.Y. Lin International as structural engineer, and William Tao & Associates as the mechanical engineering contractor.
- Saudia Arabian Bechtel Co., Ltd.—the local subsidiary of the Bechtel Group—serves as planner, designer, and project manager for the King Fahd International Airport. Minoru Yamasaki & Associates, of Troy, Michigan, won the contract for architectural design of the terminal complex.
- A joint venture of three American firms—Paul N. Howard Co., Harbert International, and Sadelmi, Inc.—has begun the first stage in what will be a $2.6 billion rehabilitation of the Cairo sewer system. Local subcontractors will do most of the physical work.
- AEGIS Construction has won a contract to design and build 125 units of family housing at the U.S. naval base at Guantanamo, Cuba.
- M.W. Kellogg's British subsidiary recently won a contract for engineering, procurement, and construction supervision for an ammonia plant in Hull, England.
- Scientific-Atlanta has a contract to procure equipment for and build 12 satellite Earth stations in Gabon.
- Morrison-Knudsen International designed and is constructing a $2 billion coal mine and port on the Guarjira Peninsula in Colombia—the Cerrejon Mine/Puerto Bolivar project. This is Columbia's largest development and the world's biggest award to a single contractor. Most of the labor force was hired locally, with 380 Americans in a work force that reached a peak of 11,000.

Contracts take two common forms: design-bid-build, and design-construct. Under the design-bid-build sequence, design and construction take place under separate contracts. Specifications developed in the design phase form the core of a request for bids on the construction work. (Typically, the client selects the design firm based on an evaluation of qualifications.)

Design-construct procedures eliminate the intermediate bidding stage, so long as the client is satisfied with the earlier work. One contract covers the entire project—design and engineering, construction, and perhaps even installation of equipment (for a turn-key project). The lead contractor might later provide O&M services. Turn-key or total package approaches have the benefit of simplicity for the client, who need deal with only one firm.

The design-construct process aims for better cooperation between the design and construction teams; the design-bid-build system fosters separation, even antagonism, between designer and builder—a tradition that persists in the American E&C industry, even within integrated firms. Current policies at both the World Bank and the Inter-American Development Bank permit clients funded through bank programs to award design contracts as follow-ups to earlier feasibility studies without reopening the bidding process. If the client has been satisfied with the feasibility study, the presumption of this "continuity of work" principle is that sticking with the same firm will be more efficient and less disruptive during the design phase, given that the E&C firm has developed an understanding of the client's needs. Likewise during construction, continuity of work implies that staying with the same firm will eliminate the cost of learning and mobilization that a new firm would incur and charge to the client.

Many bidding variations exist. For example, United Arab Emirates picks the lowest five bids for a rebidding process, or negotiates down to the lowest price offered. Indonesia awarded the contract for the Jakarta Airport after three rounds of bidding. Other nations have negotiated selectively with or invited bids from individual companies.[1]

For large and complex projects, which may be broken down into thousands of individual work packages, site management becomes a critical factor in controlling costs and meeting

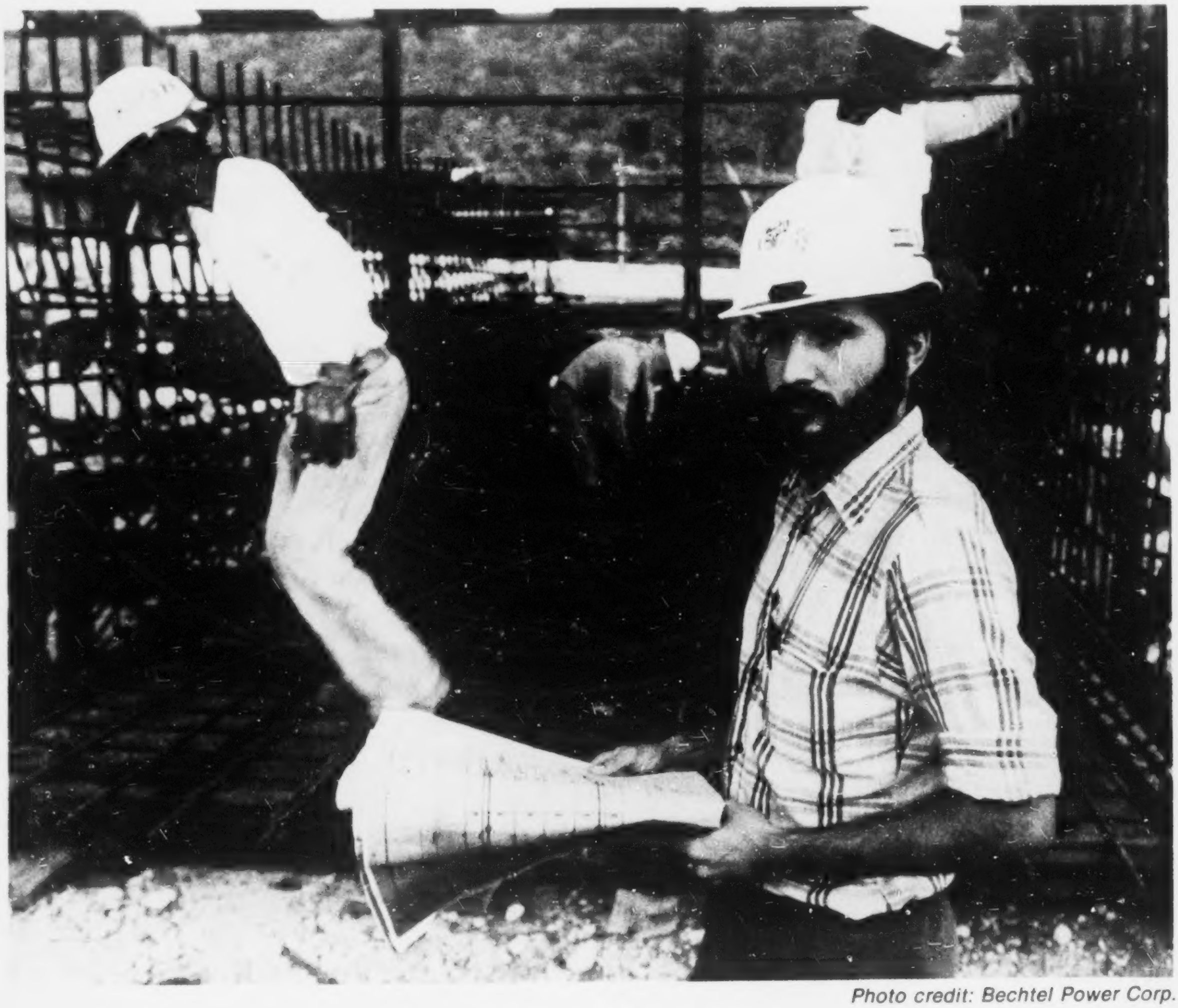

Photo credit: Bechtel Power Corp.

Construction project under U.S. management in Southeast Asia.

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[1] A. Demacopoulos and F. Moavenzadeh, "International Construction Financing," TDP Report 85-3, Massachusetts Institute of Technology, Technology and Development Program, June 1985, pp. 73-74.

Information in this chapter not otherwise cited generally comes from interviews.

schedules, and hence in the ability to put together a winning bid. Tasks such as tracking incoming supplies, onsite warehousing, releasing drawings (and preparing as-built drawings when changes must be made in the field) on a large project can be overwhelming. For example, Morrison-Knudsen's Cerrejon Mine project involved 200 subcontractors and 2,100 suppliers. In order to control costs, construction companies have begun using onsite computer systems (box J). American firms have been leaders in software for onsite management, and in the use of personal computers in the field.

The Industry

Domestically, construction is one of the largest sectors of the U.S. economy. Well over a million firms, most of them small, employ more than 5 million Americans. New construction in the United States during 1985 accounted for nearly 9 percent of the gross national product. But only a few thousand American E&C firms do business internationally.

Residential building comprises more than 40 percent of domestic construction (figure 26), with industrial plants and civil works of all types (roads, bridges, dams, irrigation systems, water and sewer systems, pipelines, ports) making up another 30 percent. Commercial and other nonresidential buildings account for most of the rest.[2] Residential housing remains the domain of local firms, both in the United States and overseas. The international E&C market consists mostly of design and construction for industrial facilities, civil works, and, to a lesser extent, nonresidential buildings.

Of the 400 largest contractors in the United States, only 60 gained new contracts for foreign work during 1985.[3] A few big companies, in turn, dominate this small export-oriented group, with eight construction firms accounting for more than 80 percent of new foreign awards by value. Similar patterns hold in other countries, with international contracts making up a substantial part of the total revenues of the largest firms and/or those that specialize in this part of the business (table 14). For the U.S. industry as a whole, foreign revenues—although totaling $7.7 billion to $8.1 billion in 1983—account for only a few percent of total receipts (3 percent in 1983).[4]

Relatively more design firms do business internationally than construction companies (many of the large E&C firms offer both design and construction services). Of the 500 largest U.S. design firms, 258 reported foreign billings in 1985.[5] Figure 27 gives the breakdown by type of project, including both domestic and foreign awards, for 1984 (the latest year for which such data are available). Small design firms, particularly, are more likely to be active in the international market than small construction companies. Nevertheless, of more than 45,000 establishments providing engineering, architectural, and surveying services in the United States, only about 4 percent report foreign receipts. However, those that do have foreign sales get, on the average, more than 20 percent of their revenues overseas.[6] For the design portion of the E&C industry, OTA estimates that foreign revenues came to about 14 percent of domestic revenues during 1983 ($5.1 billion to $5.6 billion, compared with $37.3 billion domestically), with affiliate sales considerably more important than in construction.[7]

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[2] See *Trade in Services: Exports and Foreign Revenues* (Washington, DC: Office of Technology Assessment, September 1986), pp. 58-61 and 65-67. Also *1986 U.S. Industrial Outlook* (Washington, DC: Department of Commerce, February 1986), chs. 1 and 67.

[3] "U.S. Recovery Fuels Work Again," *Engineering News-Record*, Apr. 17, 1986, p. 98. The figure was 66 in 1984. This group got 21 percent of its total contract awards overseas during 1985.

[4] These figures are OTA estimates—*Trade in Services*, op. cit., p. 60. Of the $7.7 billion to $8.1 billion, $4.8 billion consisted of direct exports—e.g., construction services produced in the United States for customers overseas; OTA estimates place the sales of foreign affiliates of U.S. construction firms at $2.9 billion to $3.3 billion in 1983.

[5] "Designer Billings Reached Record of $11 Billion," *Engineering News-Record*, May 15, 1986, pp. 32-50.

[6] *1982 Census of Service Industries: Miscellaneous Subjects* (Washington, DC: Department of Commerce, 1985), p. 5-142.

[7] *Trade in Services*, op. cit., pp. 65 and 67. OTA places direct exports of design services at $1.1 billion to $1.6 billion in 1983, much less than the estimated $4 billion in sales by overseas affiliates of U.S. design firms.

Box J.—Piping Design and Construction Management Technologies

For refineries, petrochemical plants, and power stations, fabrication and installation of piping may be the single most expensive part of the construction process. With miles of pipe of many different sizes, thousands of sensors, valves, and pipe hangers, and tens of thousands of welds, the design process itself is laborious and expensive. In earlier years, three-dimensional models were needed to check for clearances; today, much of the spatial design can be done with CADD systems. Particularly in nuclear powerplants, piping systems must be designed so that neither expected nor unusual loads (e.g., earthquakes) will cause ruptures; both piping runs and hangers will affect vibratory modes and the loads at each point. Calculations are very complex; today, they are carried out on large computers.

The pipe itself is expensive, particularly when specialty metals (e.g., nickel-base alloys) must be used to resist corrosion or high temperatures. Welds must be checked, often with X-rays. Pipes may need to be insulated after fabrication. For a large power station, conventional or nuclear, the materials and labor for the piping can run to half a billion dollars or more. Piping may account for 40 percent of total labor hours on the job site. Mistakes leading to scrappage or extensive rework can cost millions.

Piping fabrication—e.g., cutting and bending—normally takes place in an onsite shop. As an alternative to using elbows, induction heating following by bending under computer control can greatly reduce the number of welds and hence cut both fabrication and inspection costs; savings may be 20 to 40 percent.* While U.S. construction companies have begun to use induction bending, the technology has been developed in Europe and Japan, and continues to be controlled by firms outside the United States.

Offsite fabrication can also lead to savings, particularly for projects in countries with limited pools of skilled labor. For the Al-Jubail refinery, in Saudi Arabia, a Japanese firm built modules weighing up to 2,500 tons at its home facilities. After shipment from Japan by sea, the modules were moved 6 miles on a specially constructed roadway to the refinery site.

Other sources of future savings in piping-intensive construction will include direct control of pipe bending equipment from CADD databases, greater use of automated welding equipment and robotics during installation, and automated real-time inspection of welds (ultimately, closed-loop control of the welding process may obviate inspection except on the most critical welds).

Electrical wiring—also involving many components and labor-intensive installation—presents an analogous set of opportunities for automation and costs savings. Bechtel, for example, has scaled down a mainframe computer program for cable and raceway scheduling to run on PCs at the construction site. Designers enter data on each electrical component into the system at the home office. When parts, components, and subassemblies are delivered, warehousemen log them in using optical scanners to read bar codes and computer-generated control cards. As the job progresses, workers enter discrepancies and field changes into databases maintained both at the home office and the construction site.

Far more can still be done to improve productivity in construction through improved management systems. On some large projects, workers may be idle as much as two-thirds of the time while waiting for the materials or tools for the next task.** Such examples suggest the potential of computer-based construction management systems, now in their infancy, for smoothing the flow of work and cutting costs. They will be extensively developed and applied over the next 10 to 15 years, not only for piping and electrical wiring, but for many of the other tasks commonly found in complex construction projects. In principle, components can already be coded and tracked from the design phase (engineering specifications), through fabrication (material lots, delivery and warehousing, construction and inspection), and a database maintained over the life of the plant or facility. In practice, however, most companies still work with a number of independent databases, handing control from one to the next at successive stages in design and fabrication. The companies that develop and apply computer-based construction management systems most effectively will have substantial advantages on large international projects in the future.

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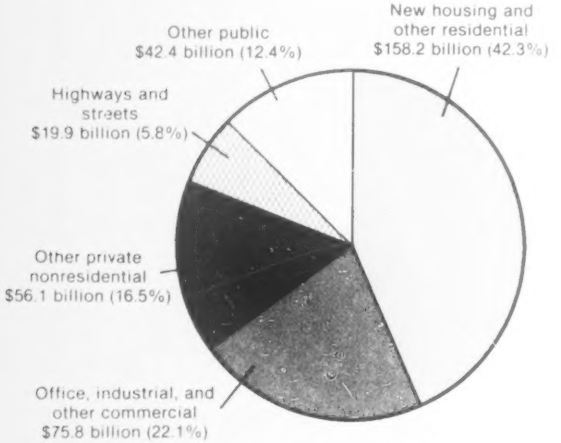
*"Final Report, Tasks 1/2, Technology in Architecture, Engineering, and Construction," prepared for OTA by D.W. Halpin under contract No. 633-1970, p. 42.

The Al-Jubail example below comes from p. 32, the information on Bechtel's computer management of electrical wiring from pp. 26-27.

**"Final Report, Task 3, Technology in Architecture, Engineering, and Construction," prepared for OTA by D.W. Halpin under contract 633-1970, p. 2.

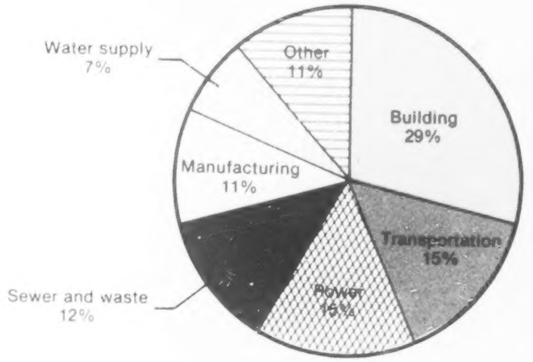
Figure 26.—New U.S. Construction, 1985



Total: $342.4 billion

SOURCE: "Annual Value of New Construction Put in Place in the United States in Current Dollars and 1977 Dollars," *U.S. Department of Commerce News*, Apr. 1, 1986.

Figure 27.—Total Billings, Domestic and Foreign, for 500 Largest U.S. Design Firms by Type of Project, 1984



Total: $9.6 billion

SOURCE: "Design Billings Gain 12 Percent in 1984," *Engineering News-Record*, May 16, 1985, pp. 36-66.

Table 14.—Leading International Contractors, 1980 and 1985

1980			1985		
	New contracts (billions of dollars)			New contracts (billions of dollars)	
	Foreign	Domestic		Foreign	Domestic
American firms:					
Bechtel Group	$8.5	$2.1	M.W. Kellogg	$6.2	$0.6
Parsons	8.3	1.1	Parsons	5.0	3.6
Fluor	5.0	4.1	Bechtel Group	3.6	3.8
Foster Wheeler	2.8	1.8	Brown & Root	2.9	2.7
C-E Lummus	2.7	1.6	Lummus Crest	2.4	1.1
Japanese firms:					
Chiyoda	$1.3	0.3	Kumagai Gumi	$2.2	$2.5
JGC	0.7	0.4	Mitsubishi	1.4	3.0
Toyo Engineering	0.5	0.1	JGC	1.0	0.4
European firms:					
Philipp Holzmann (West Germany)	$2.5	1.2	Philipp Holzmann (West Germany)	$1.9	1.3
Bilfinger & Berger (West Germany)	2.4	0.6	SADE/SADELMI (Italy)	1.8	—
Davy (Britian)	2.4	0.1	John Brown (Britain)	1.7	0.4
Korean firms:					
Hyundai	$1.4	$0.2	Hyundai	$2.0	$0.5
Daelim	0.8	0.3	Daewoo	0.9	0.4
Daewoo	0.8	0.1	Daelim	0.5	0.4
Other:					
Mendes Junior (Brazil)	$1.5	$1.4	Enka (Turkey)	$1.1	$0.5
Solei Boneh (Israel)	1.3	—	Joannou & Paraskevades (Cyprus)	0.5	—

SOURCE: *Engineering News-Record*, various issues.

Relatively few Americans work overseas on projects carried out by U.S.-based E&C firms; generally, they fill only the higher level managerial and technical positions. In the past, it was more common for skilled jobs—surveyors, heavy equipment operators—to go to Americans, but most of these are now filled in the host country, or by people from third countries who get lower wages. Laborers and semiskilled workers come almost entirely from host and third countries; U.S. firms with contracts in the Middle East, for example, have hired large numbers of South Koreans. In 1983, U.S.-based E&C firms employed 45,000 Americans on international projects and 99,000 foreign workers, exclusive of subcontracting.[8] Of the Americans, about 19,000 worked outside of the United States and 26,000 at home. In recent years, U.S.-based firms have also tended to let larger numbers of subcontracts to foreign companies, taking advantage of their lower labor costs.

Downstream Linkages

While E&C firms may underprice their feasibility studies in hopes of landing a follow-on design contract, and may hope that a design contract will carry over to the construction phase, this happens only some of the time. And, while a design contract by one U.S. firm may raise the probability that it or another U.S. firm will get the construction contract—perhaps because the design calls for construction technologies in which American firms specialize—one study of large projects during the 1970s found only 43 percent of projects with U.S. designers/consultants subsequently going to U.S. construction firms.[9] Thus, exports of design do not automatically lead to exports of construction.

A second set of downstream linkages also begins at the design stage. Merchandise sales—e.g., capital equipment—often follow quite directly from exports of E&C services. Part of the reason is simply that design firms tend to specify equipment they are familiar with, so that American E&C firms turn naturally to American-made goods (table 15). Furthermore, American-made equipment commonly demands American-made spare and replacement parts. Contracts for O&M training and management services also follow logically from the export of design services and equipment.

Today, with comparable equipment available in a greater number of countries, this set of linkages is not so strong as a decade ago, and will probably continue to weaken. Under continuing pressure to cut costs, American firms have been purchasing or specifying foreign materials and supplies more frequently than in earlier years. Still, in a survey by the U.S. International Trade Commission, 33 of 38 American E&C firms said that they specified or recommended U.S. equipment.[10] Sometimes, of course, the purchaser (rather than the E&C firm) specifies American (or other foreign) equipment for reasons of price or reputation. Nonetheless, most

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[8] "The Contribution of Architectural, Engineering and Construction Exports to the U.S. Economy," prepared by Price Waterhouse for the International Engineering and Construction Industries Council, Washington, DC, April 1985, p. 17. Comparing total payroll costs, including fringe benefits, for U.S. and foreign workers demonstrates the motives for hiring foreigners: payroll costs for the 45,000 Americans totaled $2.2 billion (an average of $49,000), costs for the 99,000 foreign workers only $1.4 billion ($14,000, on the average).

Direct exports provide about 1 percent of total U.S. E&C industry employment. Assuming all 45,000 Americans were involved in industrial or civil works, they made up perhaps 3 percent of U.S. employment in this sector of the E&C industry. A higher fraction of employment can be traced to exports in many of the capital goods sectors that depend in part on construction projects for sales. For example, according to the U.S. International Trade Commission, 4.3 percent of U.S. jobs in the heating, plumbing, and structural metal products industry depended on exports in 1982, 31 percent in construction and mining machinery, and 34 percent in engines and turbines—*U.S. Trade-Related Employment*, USITC publication 1445 (Washington, DC: U.S. International Trade Commission, October 1983), pp. 49-50.

[9] K.J. Murphy, *Macroproject Development in the Third World* (Boulder, CO: Westview, 1983), p. 138. Other downstream linkage percentages: West Germany, 80 percent; Japan, 63 percent; France and Italy, 50 percent; Britain, 13 percent.

[10] *The Relationship of Exports in Selected U.S. Service Industries to U.S. Merchandise Exports*, USITC Publication 1290 (Washington, DC: U.S. International Trade Commission, 1982), p. 62.

A survey of projects with financing from the U.S. Export-Import Bank found that, when the design firm was American, 80 percent of imported equipment was purchased from American companies. With design engineering firms from other foreign countries (not the host country), the percentage dropped to 43 percent. See C. Becker and F. Wilson, "Addendum to Architectural and Engineering Services Sector Study—June 1984," Export-Import Bank of the United States, Washington, DC, July 27, 1984.

Table 15.—Typical Examples of U.S. Goods Exports Resulting From an Overseas Energy Project

Likelihood of U.S. goods purchases relative to foreign goods		
Above average	Average	Below average
Fired heaters, including furnaces ovens, boilers, flues, and related products	Pressure vessels and columns, including towers, and reactors	Fabricated piping of all types
Pumps and drives, all types	Heat exchangers, including condensers and evaporators	Tanks, bins, and hoppers
Vacuum equipment (vacuum pumps, ejectors)	Instruments, including safety valves, indicators, and panels	Materials-handling equipment—e.g., bucket elevators, conveyors, cranes, hoists, weighing devices, hoppers
Sawmill and planing mill equipment	Electric motors, motor controls, and transformers	Plywoods and veneers
Equipment for refining petroleum, and miscellaneous products of petroleum and coal	Compressors and drives, including blowers and fans	Plumbing fixtures, fittings, and trim
Miscellaneous plastic products	Crushers, pulverizers, and blenders	Fabricated structural metal products
Heating and refrigeration equipment	Water and waste treatment equipment, including clarifiers, chemical feeders, mixers, and agitators	Pipes, valves, and fittings
Switchgear and switchboard apparatus	Paints and allied products	
Wiring devices	Nonferrous wire drawing and insulating equipment	
	Lighting fixtures and equipment	
	Fabricated plate work	

SOURCE: E.C. Stokes, Vice President Procurement, Bechtel Power Corp.

of the total project budget on a large international project normally goes for non-U.S. goods and services, even when the contractor is based here. A 1983 survey of American firms by Price-Waterhouse found that only about a quarter of their spending on international projects went to cover expenses incurred in the United States. On the average, about 11 percent went for salaries and fringe benefits of U.S. employees (excluding employees of U.S. subcontractors), 10 percent for the purchase of equipment and materials from other American firms, and 5 percent for subcontracts to U.S. firms.[11] Most of the remaining 74 percent paid for goods and services purchased overseas.

When comparable goods (or subcontract services) are available from many sources, price will usually be the determining factor. Basic building products—lumber, cement, and fabricated steel—tend to be purchased in the host nation or from low-cost third-country suppliers. Today, American firms will also normally specify standardized or commodity-like products—e.g., many kinds of piping and materials-handling equipment—based largely on price. In addition, protected markets for host country construction and supplier industries may limit an E&C firm's ability to specify foreign goods and services, with local procurement requirements often written into contracts. As table 15 suggests, American suppliers begin to have advantages where proprietary technology makes a difference, as for refinery equipment. In other countries, E&C firms may work more closely with suppliers, particularly where one or both are publicly owned, or when governments participate by providing export credits; the president of Italy's state-owned industrial group, IRI, has said, "The first priority . . . is to promote the work of Italian suppliers."[12]

The International E&C Market

Figure 28 summarizes conditions facing American construction firms: a shrinking world market, caused in large part by economic problems in the LDCs, coupled with intense competition as firms from many countries strive to maintain hard-won positions. Economic growth rates have been declining in the developing world—figure 29. At the same time, the exter-

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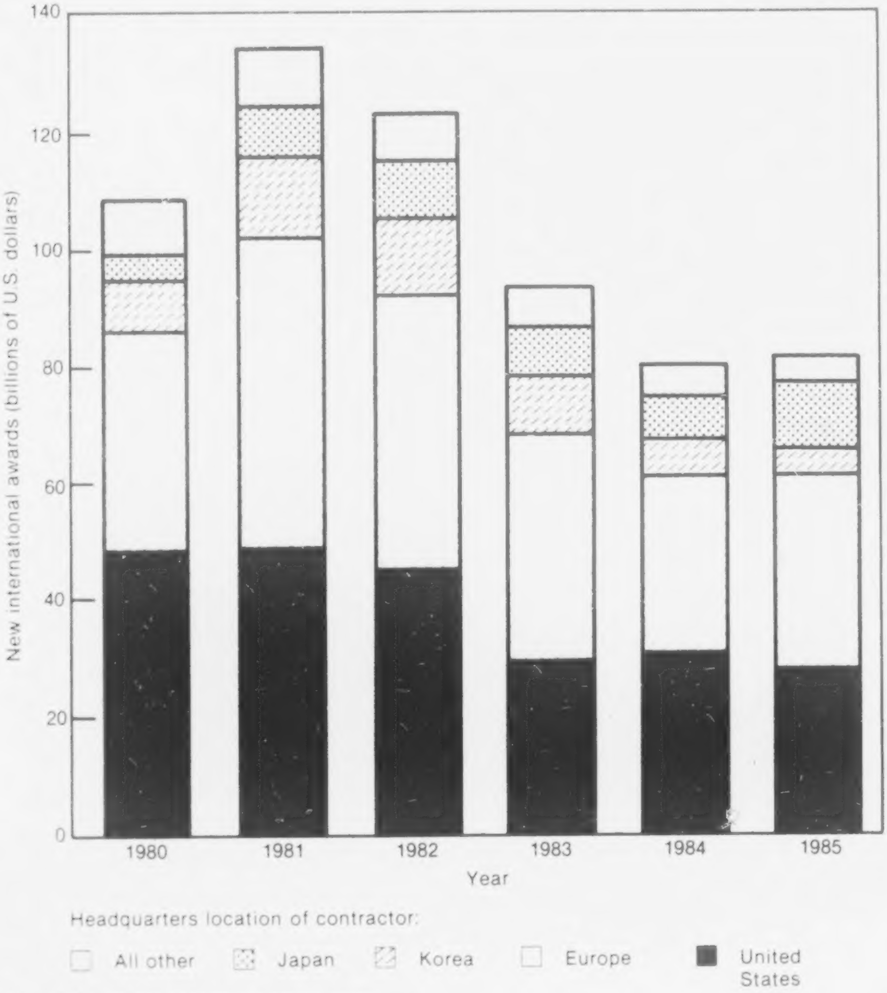
[11] Such figures can vary a good deal from year to year, with a few major projects producing large swings in the proportions spent here and abroad. Those quoted are from "The Contribution of Architectural, Engineering and Construction Exports to the U.S. Economy," op. cit., with corrections supplied by Price-Waterhouse to OTA. This survey found that, in 1983, foreign contracts to U.S. E&C firms totaling $19.6 billion resulted in $2.2 billion in U.S. salaries and fringe benefits (excluding subcontractors), $1.9 billion in purchases of U.S. goods, and $1.4 billion in U.S. subcontracting. A total of $13.4 billion went for goods and services purchased in the host nation or in third countries (foreign expenses), with the remainder for miscellaneous items such as tax payments. For 1982, $21.7 billion in contracts resulted in purchases of $2.8 billion in U.S. materials, $2.2 billion for U.S. salaries and fringe benefits, and only $800 million for U.S. subcontracting, with $15.3 billion for foreign expenses.

[12] "Italian Engineering & Construction 1986," *Engineering News-Record*, June 12, 1986, p. 1-6.

Figure 28.—New Contract Awards of the 250 Largest International Contractors



SOURCE: *Engineering News-Record*, various issues.

nal debt of the LDCs has grown—from almost $400 billion in 1978 to an estimated $1 trillion in 1987.[13] Many developing countries cannot service their existing debt, much less contemplate expensive new construction projects.

Among the reasons for the deteriorating economic picture illustrated by figure 29, perhaps the most significant has been the fall in prices for non-oil commodities—particularly food and primary metals. For the Middle East, of course, the problem has been declining oil exports, and, more recently, falling prices, leading to economic slowdown; the current account of the oil exporting nations as a group shifted from a surplus of $95 billion in 1980, to an estimated

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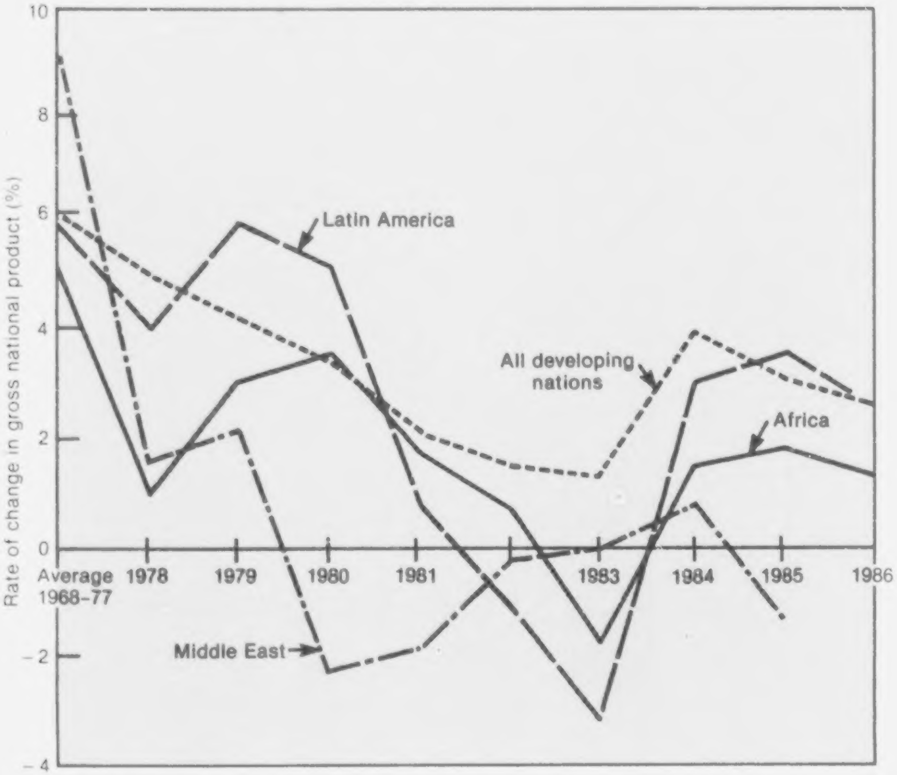
[13] *World Economic Outlook* (Washington, DC: International Monetary Fund, October 1986), p. 100. For the current account figures for oil exporting countries, below, see p. 78.

In 1977, 15 percent of revenues that the indebted developing nations earned through exports went to debt payments; by 1982, debt service payments had peaked at 24.6 percent of total exports. For many individual countries, the situation was much worse; in the Western Hemisphere, over half the exports of the indebted developing nations in 1982 went toward debt payments. (An indebted nation has external debts greater than external assets; in practice, this includes all LDCs with the exception of Middle Eastern oil exporters.)

Figure 29.—Economic Growth in the Developing World



SOURCE: *World Economic Outlook* (Washington, DC: International Monetary Fund, October 1986), p. 37.

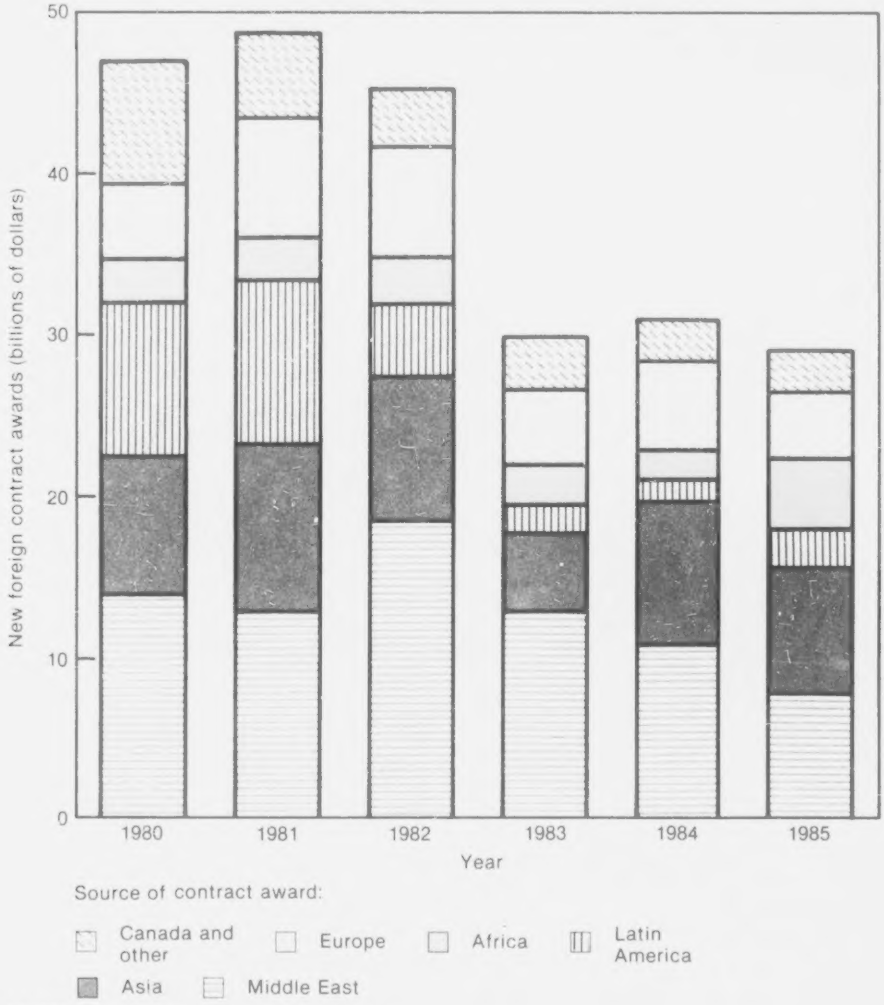
$39 billion deficit in 1986. Given their debt servicing problems, and the fall in commodity prices (including oil), developing nations have generally been unwilling or unable to borrow capital to finance major development projects. This is the context for viewing the declining U.S. share of international E&C projects.

Construction

American construction firms (design and engineering are treated later) get much of their international business in Asia and the Middle East. Figure 30 shows the extent to which the Latin American market, large in the early 1980s, has dried up—a casualty of the economic problems summarized above; since 1982, U.S. firms have done as much or more business in Canada as in all of Latin America.

The dropoff in the Middle East has also been severe. Nonetheless, table 16—which gives new contract awards by region during 1985 for construction firms from different countries—shows that the Middle Eastern market continues to be particularly important for American contractors. European firms do especially well in Africa, a result in many cases of continuing ties with former colonies. In 1984, the 41 U.S. firms among the 250 largest international contractors (in that year) had a share of the international market slightly greater than that of the European firms (38.1 compared to 37.1 percent). In 1985, however, the U.S. market share fell below that for the Europeans, as the table indicates. Indeed, it has been dropping steadily for 15 years. Over the period 1966-71, American firms captured nearly 70 percent of the foreign construction orders won by companies from

Figure 30.—Foreign Construction Awards of the 400 Largest U.S. Contractors



SOURCE: *Engineering News-Record*, various issues.

Table 16.—New Contract Awards for the 250 Largest International Contractors, 1985

Number of firms	Country of ownership	Total new awards by region (billions of dollars and percentage)													
		Total awards		Middle East		Asia		Africa		Europe		Latin America		North America	
43	United States	$28.2	34.6%	$ 7.8	36.0%	$ 7.1	39.9%	$ 4.5	29.1%	$ 4.2	42.3%	$ 2.3	34.8%	$ 2.3	23.0%
116	Europe	32.6	39.9	6.1	28.4	4.3	24.3	7.5	48.7	5.5	55.3	3.6	53.2	5.5	54.2
39	Japan	11.6	14.3	1.9	8.8	5.4	30.6	1.6	10.8	0.2	2.3	0.5	7.1	2.0	19.2
17	South Korea	4.8	5.8	3.4	15.6	0.4	2.1	1.0	6.5	—	—	—[a]	—	—[a]	—
35	All other	4.4	5.4	2.4	11.2	0.5	3.0	0.7	0.5	—	—	0.3	4.9	0.4	3.6
250	All	$81.6	100%	$21.6	100%	$17.8	100%	$15.3	100%	$10.0	100%	$ 6.6	100%	$10.2	100%

[a] Less than $50 million.

NOTE: Totals may not add because of rounding.

SOURCE: *Engineering News-Record*, July 17, 1986, p. 41.

six major industrialized nations.[14] By 1980, the U.S. share of new contracts going to these six nations had dropped to 60 percent, and 1984 saw a still smaller share of 49 percent.

Why did the U.S. share drop? Largely because exports of E&C services from other countries grew faster. With the rapid increase in new construction projects in the Middle East during the 1970s, U.S. E&C exports jumped, rising from about $3.6 billion in 1972 to some $22 billion in 1975. However, this growth did not necessarily translate into a larger share of the international construction market for U.S. firms; construction exports from other nations rose as fast or even faster during the peak years of the Middle East building boom. South Korea's rise was especially striking; Korean construction exports rose from $83 million in 1972 to $8 billion by 1978, peaking at $13.9 billion in 1981.[15] Meanwhile, for American firms, 1975 marked the beginning of a plateau, although exports from countries like Korea continued to climb.

U.S. market share has been sliding ever since. As figure 28 indicated, the U.S. share of all international contracts was 35 percent in 1985; it had been 45 percent in 1980. While the United States continues to export far more construction services than any other nation, the relative slide has been rapid. Foreign firms have been continually nibbling away at the U.S. position. With a growing number of competent firms, and increasingly homogeneous technologies, the pattern is one of convergence in competitiveness; particularly since 1982, price competition in a shrinking overall market has been very intense. As in so many other industries where the international standing of U.S. firms has been threatened, many of the causes lie as much in improvements elsewhere as in problems here.

Foreign government policies have contributed to this convergence. Governments dictate the conditions under which foreign-owned E&C companies do business within their borders. In the 1950s and 1960s, an American firm could bid on and win contracts calling for most of the engineering and design work to be undertaken in the United States. Today, many governments insist that the work take place locally. They also seek transfers of proprietary technologies. In many cases, this means that U.S.-based E&C firms station a small nucleus of highly skilled specialists in the host country, where they supervise and train local residents. Through such policies, developing countries have nurtured their own E&C capability, and today depend less heavily on foreign expertise.

Design and Engineering

Overseas work for American design firms has remained relatively stable, in contrast with the slump in construction. Foreign billings of U.S. design firms fluctuated between $1.1 billion and $1.4 billion over the first half of the 1980s (table 17). Figure 31 shows the market shares of the top international design firms. U.S. design firms have been, by and large, holding their own internationally. The Middle East has been a ma-

Table 17.—Revenues of the 500 Largest U.S. Design Firms (billions of dollars)

	Foreign revenues	Domestic revenues
1980	$1.1	$6.1
1981	1.2	7.1
1982	1.4	7.1
1983	1.3	7.3
1984	1.1	8.5
1985	1.3	9.7

SOURCE: *Engineering News-Record*, various issues

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[14] R. Bah Neo, *International Construc~~tion Con~~tracting* (Epping, Essex: Gower Press, Bowker Publishing Co., 1976), p. 38. The shares over the 1966-71 period were:

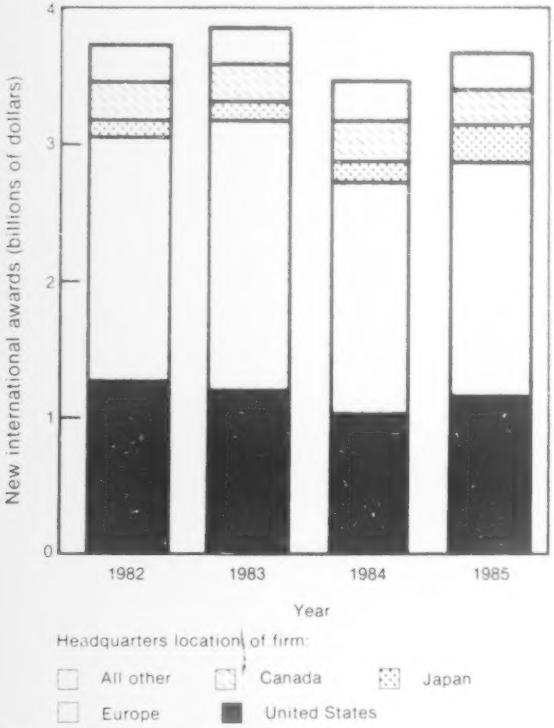
United States	*France*	*Britain*	*Italy*	*West Germany*	*Japan*
68.9%	11.1%	9.1%	6.3%	3.2%	1.3%

Historical data on the international E&C market are hard to come by, and not necessarily comparable from year to year. In general, the annual surveys conducted by *Engineering News-Record* (ENR), drawn upon where possible in this chapter, provide the most useful data. Nonetheless, these surveys are of questionable accuracy; some firms in some years, for instance, may understate their business, while others have reasons for overstating their awards. ENR's surveys of the top 250 international contractors did not begin until 1980, while their coverage of international design firms only became standardized at 200 firms in 1982.

[15] R. Cortincvis and M. Colombard-Prout, *La Coree du Sud et la Question des Exportations de BTP* (Paris: Centre Experimental de Recherches et d'Etudes du Batiment et des Travaux Publics, 1982), p. 150.

More recently, the collapse of the Middle East market has badly hurt the South Korea construction industry. Exports of South Korean firms ranked among the largest 250 international firms declined from their 1981 peak to $4.8 billion in 1985.

Figure 31.—New Contract Awards of the 200 Largest International Design Firms



SOURCE: *Engineering News-Record*, various issues.

jor international market for U.S. design firms (figure 32). While the recent drop in opportunities in the Middle East has hurt, U.S. design firms—unlike their counterparts on the construction side of the business—have been able to find replacement markets in other parts of the world—e.g., Latin America.

As table 18 indicates, the industrialized nations—basically the members of the Organization for Economic Cooperation and Development (OECD)—continue to monopolize the international market for design and engineering contracts. None of the NICs has carved out an international position comparable to that of the Koreans in construction. This does not mean that the NICs are not active. *Engineering News-Record*'s listing of the 200 largest international design firms includes companies from South Korea, Taiwan, Brazil, and Venezuela. But as table 18 shows, the international billings of the four Korean firms making the 1985 list totaled less than $50 million.

Outlook for the Future

Given the past importance of the Middle Eastern and Latin American markets, falling oil prices and increasing LDC debt have drastically affected the competitive fortunes of American E&C companies. Is it possible that the deteriorating U.S. position outlined above is temporary, subject to reversal with improving economic conditions in the developing world? Certainly an economic upturn would bring new demand for construction and help American firms. Nevertheless, the international E&C market has changed fundamentally, and in ways that make it unlikely that American companies will return to the positions they held in the early 1970s.

The primary reason has already been mentioned: rising competence elsewhere, as demonstrated most spectacularly by the rise of the South Korean construction industry during the 1970s. And it is not only the E&C firms in the NICs that have matured, but those in the LDCs as well, aided by participation alongside U.S. and other foreign firms on past projects. (Many South Korean firms learned their trade on projects in the Middle East and Vietnam, often under the supervision of American companies.) Developing countries can now handle many construction projects on their own that once would have been opened to foreign bids. From 1980 to 1985, World Bank disbursements *within* host nations nearly doubled (this covers both goods and services for civil works projects); only one-quarter of these expenditures now go to outside firms.

Improvement in local E&C capability, of course, has been a major goal of the development process, and a cornerstone of industrialization.[16] In countries with low per-capita in-

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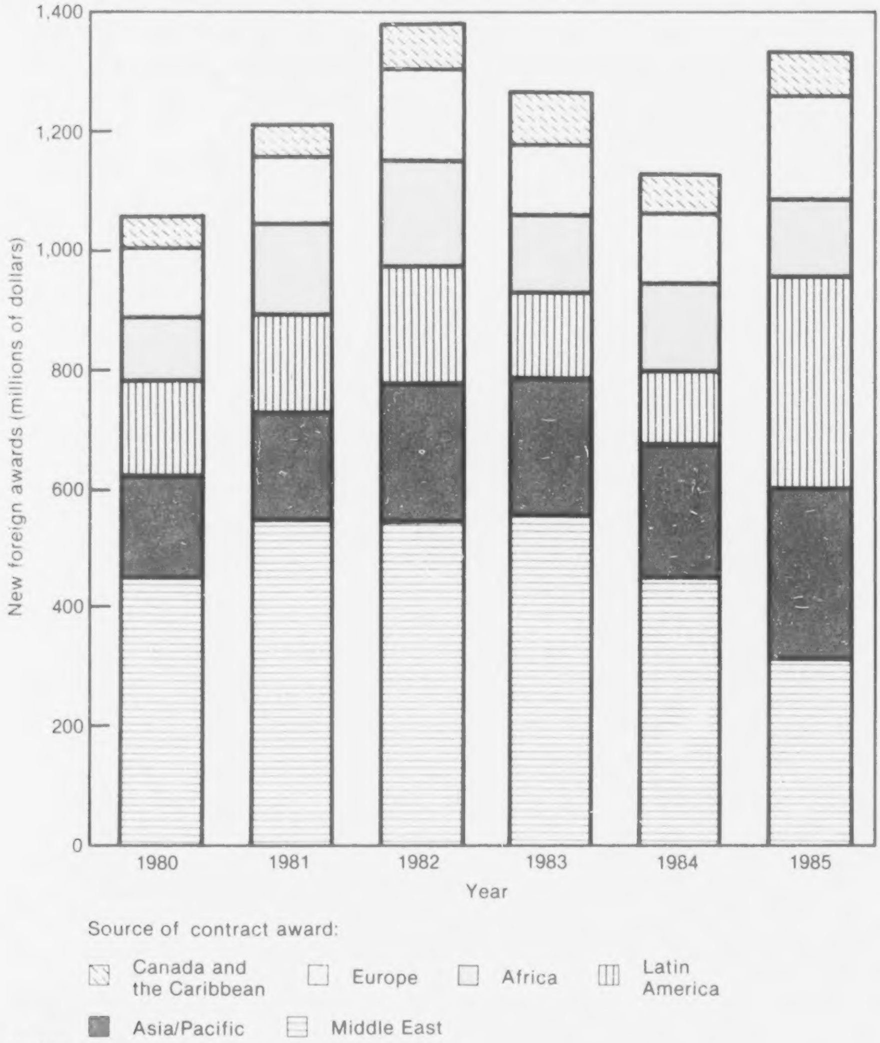
[16] *The Construction Industry: Issues and Strategies in Developing Countries* (Washington, DC: World Bank, 1984); P.G. Abbott, *Technology Transfer in the Construction Industry*, Special Report No. 223 (London: Economist Intelligence Unit, 1985). On the examples later in the paragraph, see "Third Saudi Airport Fit for Kings," *Engineering News-Record*, Dec. 19, 1985, p. 48; and "Disney Park To Smooth Weak French Market," *Engineering News-Record*, Jan. 2, 1986, p. 14.

Figure 32.—Foreign Awards of the 500 Largest U.S. Design Firms



SOURCE: *Engineering News-Record*, various issues.

Table 18.—Billings of the 200 Largest International Design Firms, 1985

		Foreign billings by region (millions of dollars and percentage)													
Number of firms	Country of ownership	Total foreign billings		Middle East		Asia		Africa		Europe		Latin America		North America	
59	United States	$1,164.5	32.0%	$303.6	31.1%	$267.6	29.1%	$127.6	16.1%	$149.9	41.9%	$294.4	64.6%	$21.5	15.2%
96	Europe	1,709.4	47.0	502.3	51.6	367.0	40.0	501.5	63.3	199.0	55.6	102.7	22.5	37.0	26.2
13	Canada	265.8	7.3	16.2	1.7	71.4	7.8	78.7	9.9	2.1	0.6	27.9	6.1	69.5	49.3
12	Japan	262.2	6.2	15.4	1.6	151.2	16.5	44.3	5.6	1.9	0.5	13.4	2.9	—[a]	—
4	South Korea	46.6	1.3	24.4	2.5	16.4	1.8	5.8	0.7	—[a]	—	—	—	—	—
16	All other	227.2	6.2	112.3	11.5	45.5	5.0	34.2	4.3	4.9	1.4	17.2	3.8	13.1	9.3
200	All	$3,675.7	100.0%	$974.1	100%	$919.0	100%	$792.0	100%	$357.7	100%	$455.5	100%	$141.0	100%

[a] Less than $100,000.

NOTE: Totals may not add because of rounding.

SOURCE: *Engineering News-Record*, August 7, 1986, p. 28.

comes, the World Bank gives bids from local contractors a 7½ percent preference. Many LDC governments have protected their supplier and E&C industries, following infant industry strategies. Regulations may require subcontracting to local firms, as well as local purchases of materials and supplies. In Indonesia, by presidential decree, subcontracting to domestic companies must accompany all awards to foreign E&C firms. The aim is to speed technology transfer. Saudi Arabia's Government hopes to see three-quarters of the contracts for the King Fahd International Airport go to Saudi companies. In pursuing such approaches, developing countries are simply following the lead of the First World. When it comes to military and other federally funded projects, the U.S. Government maintains its own set of preferences for American firms, as discussed in chapter 10 (see box II). In France, over 90 percent of the work on the new Euro-Disneyland—to be built outside Paris at a cost of more than $3 billion—has been promised to French architects, engineers, and construction firms.

Beyond the growing capabilities of indigenous firms, three decades of Third World development also mean that many of the large infrastructure and industrial projects are already in place. A resumption of economic growth will certainly bring new opportunities, but not on the scale of the past. In the petrochemical industry, for example, overcapacity in commodity products means movement toward high-value-added specialty chemicals. New plants will be smaller in scale, the contracts less lucrative. The success of the green revolution has likewise reduced the immediate need for massive irrigation and other agricultural projects. As many in the industry put it, the era of the mega-project is past. (China's $20 billion Three Gorges hydroelectric station, if it goes forward, may prove the outstanding exception.)

Structural change in this industry means more than stronger competition in overseas markets. For American E&C firms, as for American manufacturing firms, it means new competition at home. With the slowdown in the Third World, foreign contractors have begun to view the United States as the next major growth market. Companies with headquarters in Europe, Japan, and South Korea have announced plans to expand into the U.S. E&C market. Many already have operations here—table 19. The rapid rise in U.S. revenues of foreign-owned E&C firms indicates that they have been taking market share from American-owned competitors (also see figure 5 in ch. 1).

Table 19.—Foreign E&C Firms in the United States

	Number of U.S. affiliates		
	1978	1980	1983
Design and engineering services (including architecture)	40	53	58
Construction	45	70	82
	U.S. receipts of foreign-owned E&C firms (millions of dollars)		
Design and engineering affiliates	$ 669	$ 594	$ 892
Construction affiliates:			
European	$1,142	$3,896	$5,394
Canadian	61	243	144
Japanese	24	50	81
Other	317	415	1,308
Construction total	$1,544	$4,604	$6,927

SOURCES: *Foreign Direct Investment in the United States: Operations of U.S. Affiliates 1977-80* (1985); *1980 Benchmark Survey* (October 1983); and *Preliminary 1983 Estimates* (December 1985), tables 5 and E-5. All Department of Commerce, Bureau of Economic Analysis.

In some cases, foreign E&C firms have purchased American companies. One of Britain's largest construction companies, the Davy Corp., bought Arthur G. McKee & Co. of Cleveland in 1978 to form Davy-McKee.[17] The German firm Philipp Holzmann acquired a large American company, J.A. Jones Construction, of Charlotte, NC, in 1979, and later added Lockwood Green Engineers. The South Koreans and Japanese seem to prefer to establish their own subsidiaries and branch offices (Samwhan American, Kajima International), rather than purchase American competitors or enter joint ventures. As both table 19 and figure 5 show, European E&C firms had a greater presence in the United States than the Koreans or Japanese in the past. But recently the Japanese have invaded the U.S. market with startling success; their construction contracts in the United States jumped from the $81 million shown in table 19 for 1983 to $700 million in 1984, and $1.8 billion for 1985.[18]

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[17] "Overseas Firms Closing In on U.S.," *Engineering News-Record*, Aug. 2, 1984, pp. 10-11.

More recently, a Norwegian company purchased a majority share of E.W. Howell of Port Washington, NY, the 162nd largest U.S. contractor—"Norwegians Buy N.Y. contractor," *Engineering News-Record*, Jan. 23, 1986, p. 158.

COMPETITIVE STRATEGIES

Competitive advantages in the international E&C industry hinge on three interrelated factors: costs, financing, and technology (including management expertise). In part, technology determines costs, but a bidder that can assemble an attractive financial package may get a contract despite direct costs for construction higher than for the competition.

Labor is a big part of construction costs, regardless of the type of project. In the developing world, labor costs for roadbuilding can range up to 70 percent of total project costs, depending on construction method. With wages in the LDCs far lower than in the industrial countries, extensive hiring in host country labor markets is a fact of life. The average construction wage in the United States in 1983 was $12 per hour, while laborers in Ecuador earned less than $2 per day.[19] In the United Kingdom, the 1983 figure was $4.47 per hour; in Mexico, $0.65 per hour. Large wage differentials exist at technical and managerial levels as well, helping contractors from the NICs undercut those based in industrial nations. A Korean engineer or project manager working on an international project earns less than half the salary of an American in a similar job.[20]

As a result, American E&C firms seeking overseas business not only hire local workers, but often establish subsidiaries in low-wage countries. A great deal of scope remains for improving labor productivity through automation of construction processes, and high productivity—hence management skills and technology—can offset high wage costs. But at present, E&C firms from the industrialized world can generally compete for Third World projects, even hiring local labor, only in special circumstances: 1) when projects are too demanding technically for local firms; or 2) where they can offer attractive financing packages. Such financing, often arranged with the help of the E&C firm's home-country government, may include loans with below-market interest rates or unusually long payback periods.

Financing

Currently, few nations (or enterprises) in those parts of the world where the majority of international contracting takes place can assemble the necessary financial packages for large projects on their own. To be successful, bidders must offer not only competent engineering, but access to financing. This is not a new problem for the major U.S. E&C firms, which, since the 1960s, have accumulated much experience in working, not only with international lending agencies, but with aggressive private U.S. financial institutions. Nonetheless, with Third World governments strapped for cash, and with governments in other OECD countries often willing to help their own firms win contracts, the U.S. E&C industry has been operating under a considerable handicap.

Today, LDCs commonly ask foreign contractors to submit financing proposals along with their bids; Bechtel Financial Services has been involved in well over 50 major projects since

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[18] C.H. Farnsworth, "Japanese Accused On Bidding," *New York Times*, Jan. 6, 1987, p. D2; also R. Koenig, "Toyota Learns To Live With U.S. Unions," *Wall Street Journal*, Feb. 25, 1987, p. 21.

[19] *The Construction Industry: Issues and Strategies in Developing Countries*, op. cit., p. 41; *Year Book of Labour Statistics—1985* (Geneva: International Labour Office, 1985), table 1499.

[20] Even so, in the early 1980s, a Korean manager or engineer could expect a salary of more than $35,000 per year on an overseas project. Plumbers and welders could earn about $15,000 per year, and bricklayers about $6,000—double what a worker could make in South Korea. Nonetheless, these costs are low compared to salaries for Americans stationed overseas; indeed, U.S. firms complain that the $70,000 tax exemption for Americans working abroad is too little, and raises their wage costs even higher. See R. Cortincvis and M. Colombard-Prout, op. cit., p. 227.

1977.[21] In cash-poor countries, outside financing may be necessary to *create* a market. For those American firms which, unlike Bechtel and other very large companies, have quite limited financial resources of their own—and no more than peripheral experience in the mechanics of international financing—the competitive difficulties will prove severe. Many commercial banks already have unacceptable exposures in countries that otherwise would offer attractive opportunities. Winning new jobs will mean assembling imaginative financing packages on a project-specific basis. This, in turn, will call for much greater familiarity on the part of E&C companies with the intricacies of rapidly evolving international financial markets (ch. 3). At the same time, banks and other players in global capital markets will need to develop a better grasp of the financing problems peculiar to international construction.

Managers of American E&C firms face a related strategic problem, one partially outside their control: the roles taken by other OECD governments in project financing. In countries including France, Italy, and Japan, government agencies have stepped in, not only with development aid, but with export credits at below-market interest rates. The objectives have been not only to support their own E&C firms, but to secure orders for materials, supplies, and capital goods. A Japanese-led consortium, for example, won a major contract from the Turkish Government to build a bridge over the Bosporus with a package including a $205 million Japanese loan at 5 percent, at least $130 million in Italian export credits at 2½ percent to 7 ¾ percent, and commercial loans totaling $230 million.[22]

While the U.S. Government has sought international agreements to limit the use of financial subsidies, especially mixed credits, progress has been slow—not surprising, given the indirect as well as direct benefits that governments expect from their financial participation. Aside from appeals to the U.S. Government for assistance in combating foreign government interventions (or in matching foreign subsidies), American companies are not entirely powerless in pursuing offsetting strategies. They can, for instance, enter joint ventures with foreign firms that have access to subsidized financing; while such a strategy may not be ideal, it helps preserve some international business. American E&C firms can also use existing forms of assistance, including the services of the U.S. Export-Import Bank. Furthermore, the major American E&C firms are among the largest and financially strongest in the world; this has permitted them, in some cases, to take equity positions in new projects. Bechtel Power Corp., for instance, recently signed a protocol with the Turkish Electric Authority to build a $1 billion coal-fired powerplant. Bechtel and its partners will not only design, build, and finance the project, but will also enter a 15-year joint venture with the Turkish Government; some of their revenues will come from the sale of power.[23]

In the last analysis, if a foreign government wants one of its firms to get a particular contract, and if financing is a critical part of the bid package, there will be little that other bidders can do without aid from their own governments. Realistically, U.S. E&C firms will continue to have trouble competing wherever government-supported financing comes into play. Progess in the OECD toward moderating the use of mixed credits and other forms of subsidies will help, but subsidies will not disappear in the foreseeable future.

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[21] More than 40 countries sought contractor participation in financing during 1984—"Foreign Contracts Slump Further," *Engineering News-Record*, July 18, 1985, p. 55. On Bechtel, see "Financial Engineering Wins Jobs," *Engineering News-Record*, Aug. 2, 1984, p. 30.

[22] L. Ingrassia, "How Japan Sealed Deal To Build Big Bridge Spanning the Bosporus," *Wall Street Journal*, May 29, 1985, p. 1.

Ch. 10 discusses policy issues raised by subsidized financing, including mixed credits, a special case of tied aid. Tied aid refers to development grants or loans that require purchases of specified goods and services, generally from the donor nation; mixed credits combine development aid with export credits.

[23] "Buying Into Turkey," *Engineering News-Record*, Mar. 13, 1986, p. 17; D. Barchard, "Ozal Model Sets Pattern for the Future," *Financial Times*, Dec. 18, 1986, p. 6.

Not many E&C firms can venture into such arrangements, which not only demand an unusual commitment of capital, but may force the contractor into an uncomfortable entrepreneurial role. Few firms have the skills, and even fewer would view the role of owner/operator as a desirable strategy (rather than a recourse after other options were closed).

Technology[24]

In contrast to many of their foreign competitors, American E&C firms have seldom operated their own R&D laboratories or invested heavily in proprietary construction technologies. Although successful companies provide their clients with highly competent engineering advice, most U.S.-based E&C firms have seemed content to adopt construction technologies pioneered elsewhere. Even in the area of process engineering—e.g., for petrochemical plants—where American firms excel, not all have wished to develop proprietary technical positions. Although control of chemical engineering technologies has meant construction contracts in the past, managers typically rationalize this choice by pointing out that a client-oriented E&C firm should scan the terrain, maintain a high level of technical knowledge, and select the best available technologies for each client's particular needs. Independent development of proprietary technologies would, in this view, compromise the interests of clients.

Indeed, most U.S. R&D relevant to the E&C industry takes place *outside* the industry—in university civil engineering departments (where industry funding has been rare), in Federal laboratories (notably those of the Department of Defense and the National Bureau of Standards), by owners of large facilities (e.g., utilities, through the Electric Power Research Institute), and in firms that supply equipment and materials (Caterpillar, DuPont, Monsanto). A later section treats Federal Government support for R&D in more detail.

While world leaders in petrochemical and other process technologies, American companies start out behind in construction methods. In contrast, proprietary technical positions in construction have been a mainstay of competitive strategies in Europe and Japan for years, with E&C firms from these countries now well-entrenched. They have invested in R&D in construction and also in the development of specialized equipment. The German firm Dyckerhoff & Widmann holds many patents covering pre-stressing and post-tensioning of reinforced concrete. The company gets a substantial share of its earnings from licensing its patents and know-how. Another German company, Philipp Holzmann, controls a set of proprietary techniques for tunneling in frozen ground, while Japanese firms are leaders in boring where geological conditions are unstable.

The Role of Technical Expertise

Traditionally, many American E&C firms have specialized: T.Y. Lin in structural engineering of pre-stressed concrete; Guy F. Atkinson in heavy construction; Brown & Root in offshore oil projects; M.W. Kellogg in petrochemicals. Some have continued with such strategies, while others have diversified. Bechtel, with its past experience in heavy construction, including the Hoover Dam—augmented by expertise in process engineering and management—has moved into design and construction management for all types of projects. Specialized expertise determines which firms will compete for contracts. Before turning to the firm's bid and the details of financing packages, a client is likely to ask: Can this firm do the job? In fact, under design-bid-build procedures, technical qualifications become the primary criterion for awards to the design firm. Construction companies may have to pre-qualify before bidding on a job. Clients must often judge the capabilities of prospective bidders based on past performance.

Technical expertise in engineering and construction, then, stems in considerable degree from the accumulated experience of the firm. Even companies that depend heavily on international contracts tend to remain strongest in technologies important in their home market. It is no surprise to find American companies leaders in offshore drilling technologies, simply because much of the original work took place in the Gulf of Mexico. And, while American firms have a great deal of experience in telecommunication projects, they would have trouble competing with French or Japanese companies for work on high-speed railroads. The Swiss and the French have well-honed skills in bridges and tunnels for mountainous terrain. So do Japanese firms, while the additional pressures of high population density in Japan have led to unusual emphasis on underground construction. Many other examples (box K) illustrate the point: E&C expertise comes in large measure from experience in solving problems of a local nature. Thus U.S. capability in construction management stems from past experience with large and complex projects at home as well as abroad, and the U.S. lead in applying computers to management tasks throughout the economy.

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[24] This section, and most of the detailed information on E&C technology, comes from "Final Report, Tasks 1/2, Technology in Architecture, Engineering, and Construction," op. cit., and "Final Report, Task 3, Technology in Architecture, Engineering, and Construction," op. cit.

Computer Applications

With many more computers installed in the United States than in any other country, American E&C firms have a good deal more accumulated experience than their foreign competitors. They can hire people with the latest skills, and draw on the know-how of a large independent software and services industry (ch. 5). In common with other American corporations, U.S. E&C firms have already automated standard business functions like payroll and accounting. They are leaders in applications of computers to construction management and in computer-assisted design and engineering.

Firms like Bechtel, Fluor, and Ebasco have developed proprietary CADD software, generally starting with packages available from vendors. Compared with manual drafting, CADD systems cut labor hours by factors of three or more. Interactive CADD, with software that maintains an online database and automatically issues change notices, revised drawings, and updated bills of materials will lead to further savings. With integrated databases, CADD systems will be tied directly into construction processes, where U.S. firms already take advantage of the best software for estimating, project scheduling, cost accounting and control, and materials tracking (Box J). Computer-assisted engineering calculations—for structural analysis, foundation design, slope stability, earthquake resistance—have also become routine for American E&C firms.

The next step will be to apply expert systems (a form of artificial intelligence) to the more standard design calculations (and to other E&C applications—e.g., operations and maintenance). Stone & Webster, for instance, has developed expert systems for optimizing welding parameters, and for diagnosis of operating problems with pumps. Eventually, computer-assisted automation of many construction processes will become practical.

Field use of small computers will accelerate the trends outlined above, and multiply the benefits. Today, the larger American E&C firms typically operate with two levels of computer support: mainframes or powerful minicomputers for complex design, engineering, and management packages, with PCs for running smaller programs both at the head office and on the job. Where once a scheduling problem caused by, say, late delivery of materials would have been referred back to the home office, today a revised production plan can be prepared in a branch office or in the field.

Foreign E&C firms make use of some of the same techniques, but the American industry remains the leader, notably in integrating engineering and management databases—a critical step for cutting costs, and one with great potential for further savings. While Japanese and European firms have been developing computer-aided systems for management, as well as design and engineering, most fall well behind the U.S. state-of-the-art. Nor can foreign firms match the Americans in the intensity with which they use computers; Bechtel, for instance, has more than 10 times as many CADD work stations installed as the large Japanese E&C firms. For the time being, with American firms continuing to develop applications such as three-dimensional CADD, the U.S. lead should remain secure. But without continuing investments, these sources of advantage could quickly shrink or vanish.

The U.S. edge in computer-based technologies has helped American design firms hold their own in the international market, and also works to the benefit of large integrated E&C firms that offer turn-key projects. Nevertheless, when it comes to projects less demanding tech-

Box K.—Technical Knowledge in the E&C Industry: Three Examples

1. New Austrian Tunneling Method

The so-called New Austrian Tunneling Method (NATM), developed more than 20 years ago for projects in the Austrian Alps, has more recently helped foreign firms penetrate the U.S. market. With NATM, shotcrete—a fast-drying concrete-based mixture—is sprayed onto tunnel walls to stabilize them as boring proceeds. Temporary supporting structure can be minimized, with the shotcrete replacing steel or reinforced concrete tunnel liners. Polyvinyl chloride (PVC) sheeting between the layers of shotcrete provides waterproofing.

Widely used in Europe, NATM was introduced into the United States in 1983 for the Wheaton station portion of the Washington, DC subway system. The lead contractor, the Austrian firm Ilbau, won the job with a low bid of $51 million, and then submitted a proposal to use NATM at a cost of only $45 million; the job had been estimated at $84 million based on conventional methods.* This is only one example where U.S. firms appear to be well behind foreign competitors in ground stabilization techniques and tunneling technology generally.

2. Up/Down Construction**

The Up/Down construction process provides an example in which U.S. firms adopted a technique first developed in Europe. As used in the Rowes Wharf project in Boston, the Up/Down process entailed excavation of five below-ground levels while simultaneously erecting a building above. In a conventional project, the foundation would first be excavated and the below-ground structure put in place, with the building erected last. With the Up/Down process, the contractor digs a trench for the perimeter walls, while sinking interior columns to provide the foundation. Then the building goes up, while at the same time the below-ground levels are dug out around the columns. At Rowes Wharf, as each below-ground level was excavated, a floor slab was laid, and anchored to the pre-sunk columns. The floor slabs were complete except for a 30-square-foot access hole, through which the earth excavated below could be removed. In essence, the structure is built upward and downward at the same time.

On the Rowes Wharf project, the developer was willing to pay an extra $2 million in construction costs to save 4 to 6 months in schedule time. The architect, who had previous experience with the necessary design techniques, originally suggested the Up/Down method, which was independently proposed by an English construction firm. After reworking the project design, schedule, and cost estimates, the client decided to proceed. Design and construction plans were further refined by several pre-qualified construction firms. After a good deal of consultation among client, designer, and the construction firms, the developer chose an American contractor for the job, even though this firm had no previous experience with the Up/Down method. The client took out a large insurance policy.

3. Partially Automated Fine Grading

Here, the innovation came from an American company. Grading in preparation for paving roads, highways, parking lots, and airport runways must be carried out to tolerances of 1/8 inch or less. Surfaces must be accurately contoured, not only for drainage, but to minimize consumption of expensive paving materials. Given tight tolerances, grading typically begins with a crawler tractor (bulldozer) that makes a rough cut to bring the surface to within about an inch of the required elevation. Then, in the fine grading step, a highly skilled operator uses a motor grader to cut the surface to the required specification. The operation is slow and expensive. A surveying crew places stakes every 10 feet or so to guide the grader. With this conventional approach, a crew can grade about 30,000 square feet (or about two-thirds of an acre) in an 8-hour shift.

Grade-Way Construction Co., a small contractor in San Francisco, began work on automating this process in 1977. Unable to interest U.S. equipment manufacturers, Grade-Way's employees designed, built, tested, and refined a system that permits a bulldozer, rather than a more ex-

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*S. Neustadtl, "The New Underground," *High Technology*, February 1986, pp. 46-52.

**Based on "Examples of Innovation on Engineering and Construction Projects and Implications for the Construction Innovation System," prepared for OTA by C.B. Tatum under contract No. 633-2725. This report is also the source for the fine grading example, below.

pensive motor grader, to carry out fine grading. A rotating laser beam defines the plane of the cut, replacing the surveying stakes. The bulldozer carries a sensor that registers the laser beam and signals a microprocessor-based control system tied into the bulldozer's hydraulic system. Manual control of the blade in response to an operator read-out is also available, and has proved useful for training purposes.

It takes about 8 years' experience for an equipment operator to master the art of manual fine grading, but the laser-based system can be used by an apprentice. Productivity has gone from 30,000 square feet per shift to 200,000 square feet, costs from 8¢ per square foot to 1¢. (Despite this, few of Grade-Way's competitors have sought to automate their own grading operations.) Since developing its system for bulldozers, Grade-Way has adapted it to graders, bucket scrapers, compactors, and trenching equipment. As of mid-1986, the company had eight laser-based systems in use. Grade-Way's annual revenues have grown from about $1 million when development began, to more than $80 million, despite a declining local market.

Grade-Way now plans to integrate its grading system with a CADD database. At present, a design firm specifies the grade, frequently using a computerized drafting system. The resulting drawings are passed along to Grade-Way, which must enter the specifications in its own database, first for estimating, and then, if the company wins the job, for carrying out the work. Grade-Way produces a new set of drawings for use in setting up the rotating laser guidance system. Cutting out this step would lower costs still further.

nically, and for much construction, the cost savings from computer applications have generally been insufficient to counter U.S. disadvantages in labor costs. Nor, with few exceptions, does the United States lead in computer applications for engineering and management extend to construction processes themselves.

Productivity in Construction

In sharp contrast to factory production of standardized manufactured goods, construction remains a craft-based industry. Automation will change this on the job site, just as CADD has changed it in the drawing office. The eventual payoffs in the field will be enormous, although they may take many years to realize. Those companies that master computer-aided construction processes—e.g., automation applied to earthmoving or steel fabrication—will be able to carve out strong competitive positions. Some of these technologies will lead to advantages even for projects in the LDCs, most of which have abundant labor but lack skilled workers; automated construction equipment will greatly reduce the need for skilled operators (see the third example in box K).

Two paths, broadly speaking, lead to greater productivity: 1) better techniques on the job site, including automation and onsite prefabrication (e.g., using mobile shops); and 2) offsite prefabrication. With some exceptions, the United States is behind in both; indeed, productivity in the American construction industry has changed little since the 1960s. Examples of productivity improvements through better techniques include slipform construction for high-rise buildings and onsite precasting of concrete. While continuous pouring of concrete using slip forms has been adopted by U.S. companies, the Europeans continue to push into more sophisticated applications. The vast majority of U.S. companies still use manually constructed forms, while universal formwork has begun to penetrate job sites elsewhere. To take an example of onsite precasting, Ilbau, an Austrian contractor, recently built an arch bridge in Bavaria by setting in place two half-arches, fabricated on site, with the aid of a computer-controlled cable support system. Notable examples of offsite prefabrication include ocean drilling platforms —generally built in drydocks, then floated to their final destinations. Similarly, the steel caissons and parallel strand cables for the Bisan

Photo credit: Beloit Corp.

Two generations of engineering design, turn-of-the century and 1960s era. Today, computer-based graphics systems are taking over much of the drafting and design work.

Straits suspension bridge in Japan were prefabricated in their entirety, with the caissons towed to sea and sunk in place. In many parts of the world, structures such as high-tension towers can now be prefabricated and placed by helicopter.

Major productivity improvements often require new approaches to design. The European lead in concrete technologies begins with design experience and extends to the manufacture of high-capacity concrete pumps; the Japanese have begun testing still more advanced methods, with automated booms for pouring and for spreading and finishing concrete. The Danes and Swedes, especially, have become known for high-quality precast concrete. Both Japanese and European firms are working to automate the highly labor-intensive tasks of cutting, bending, and placing reinforcing bars and cables. At one time, the United States led the world in bridging, especially suspension bridges. This is no longer true. With concrete replacing steel for many bridges, the Europeans have gained the advantage. The Saudi Arabia-Bahrain causeway, built by the Dutch firm Ballast Nedam, made use of piles and spans cast on site for most of its 7¾ mile length. Ballast Nedam's experience with heavy lifting barges for assembly made this approach possible.

If U.S. firms generally lag in technologies for concrete construction, they have thus far remained at the forefront in fabricated steel structures. Here, however, the Japanese have been making considerable progress in automation, exemplified by their well-publicized robots for spraying fireproofing insulation onto girders and columns. Japanese firms have also spent heavily on R&D for automated earthmoving equipment, a technology that Komatsu has been pursuing in its efforts to win sales from U.S. heavy equipment manufacturers like Caterpillar. The Japanese are also clear leaders in soft ground tunneling, while European firms have superior technology for hard rock tunneling. Although the Japanese have successfully developed modular prefabrication methods for piping, electrical wiring, and industrial control systems—e.g., for portions of the Al-Jubail refinery in Saudi Arabia—U.S. firms have also been quick to pursue these techniques. As a final example, improvements in construction materials—e.g., synthetic fibers for use in pavement bases and drains—have again often originated overseas. While the United States has been generally strong in materials R&D, relatively little of this work has been directed toward construction. Few American E&C firms have pursued innovative applications of materials, or pushed their suppliers to develop new products.

Implications for Competition

Poor showings by U.S. firms in construction technologies can be traced back to the common strategy of seeking a position as technology broker or service provider, rather than technology originator, and also to bidding procedures in the United States. The design-bid-build system splits the responsibility for design and construction. The result? Weak incentives for E&C firms to adopt cost-saving design features, or to move toward a design-for-cost or design-for-constructability approach. Under design-bid-build, the contractor will be constrained by specifications typically established by another company. Not only may superior construction methods be precluded, but the system rewards conservative choices. Once the contractor has won a job with a fixed-price bid, there is little incentive to do anything but follow the specifications the bid was based on. In contrast, engineering firms in Europe must often submit proposals covering construction methods; with evaluation of alternative construction techniques an explicit part of the competition, they have incentives to design projects so as to take advantage of new, low-cost methods.

In focusing on the services portion of the industry, U.S.-based E&C firms have stressed management of complex projects rather than construction techniques themselves. Instead of developing their own technologies, American companies have preferred to serve as technology brokers, relying on their ability to match available knowledge with their clients' needs. This brokering strategy does sometimes lead to acquisition of technologies through licensing or joint venture agreements, but U.S. E&C

firms—except for some that have specialized in fields like petrochemical processing—have seldom invested their own funds in proprietary developments. European and Japanese E&C firms spend more heavily on R&D in construction methods, with the larger Japanese companies maintaining substantial R&D programs. In Japan, research staffs of several hundred people working on construction technologies, with annual budgets of $10 million or more, are not unknown. In contrast, few of the large U.S. firms have anyone at all working *directly* on new construction methods, although staff engineers do monitor developments elsewhere.[25]

R&D undertaken by U.S. E&C firms generally focuses on the computer applications outlined earlier, or on petrochemical and other industrial process technologies, rather than construction. In industrial process technologies, a small group of relatively specialized companies—e.g., Kellogg Rust in ammonia, Lummus Crest in ethanol—have developed strong proprietary positions. When a firm owns the process technology for, say, production of ammonia, it may be able to insist on a turn-key contract, avoiding the need to bid separately on design and construction. Even when the firm does not control the process technology, it can trade on its skills in process engineering. But the position of technology broker can be dangerous when it comes to construction methods such as tunneling or bridge building. Here, an E&C firm without a proprietary position may find itself forced to rely on its competitors for know-how, with predictable results—having to settle for second best. Technologies do diffuse to the United States—e.g., tunnel boring techniques from Europe—but foreign firms will try to protect their position through continuing refinements in methods and by maintaining a work force well-trained in the latest techniques.

American E&C firms plainly have *access* to the expertise necessary for designing projects that would make greater use of industrialized production techniques—offsite fabrication of subassemblies, automated construction (as much a function of design as of construction equipment), innovative uses of new materials. But U.S.-based E&C firms will need to reshape their corporate strategies before they can hope to take the lead in reshaping construction processes; over the past several decades, American E&C companies have adopted and adapted, but have seldom been innovators.

The Future

Battered by rapid decline in traditional markets abroad, an overvalued currency during the early 1980s, and stiffer foreign competition, large U.S.-based E&C firms have undertaken agonizing reappraisals of their strategies. Some have retrenched, scaling back business development programs aimed at overseas contracting—a choice that means participating in the international market as opportunities arise, but at a much lower levels than before. Morrison-Knudsen, for instance, has closed its foreign offices and consolidated its international sales force in San Francisco. Other companies have begun rethinking their sources of competitive strength, and how these might be nurtured or extended. Another response—common among industries threatened by foreign competition—has been to appeal for Federal assistance. In particular, American firms have sought help in matching foreign financing packages. This and other steps the Federal Government might take, as discussed below, could help the industry. But the long run ability of U.S. E&C firms to maintain a competitive position internationally will depend on their own responses to changing conditions in markets here and abroad. Different firms will choose different directions, within a range of strategic possibilities that has already become apparent. This range is not a broad one. The nature of international competition leaves few real choices.

American E&C firms face four primary constraints:

1. For projects with a heavy component of relatively unskilled labor (which may in-

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[25] During a visit to a Japanese research laboratory, a vice president of a major U.S. construction firm has been reported as saying that, if he were in charge, he would fire all the R&D staff and save the company $25 million a year—"Final Report, Task 3, Technology in Architecture, Engineering, and Construction," op. cit., pp. 6-7.

clude supervisory labor), competition is already stiff; it will grow still more intense in the future.

2. Many foreign E&C firms, including those in the Third World, can now adapt and apply a relatively broad range of technologies as needed. Once the backbone of the U.S. industry, technologically based strategies are now open even to firms from the NICs, many of which have become quite competent in design and engineering.
3. When it comes to innovation, particularly in construction processes, European and Japanese firms are ahead in some technologies. No matter the counter-efforts of U.S.-based firms, it will be difficult to regain useful leads.
4. Governments will continue to intervene in competition for international E&C projects, with this involvement taking two primary forms—aid for domestic firms seeking foreign contracts (e.g., through subsidized financing), and protection of markets at home.

Perhaps needless to say, these conditions are not unique to the E&C industry. They can also be found in many sectors of manufacturing. American E&C firms, which dominated international markets into the 1970s, have joined other U.S. companies in facing new foreign competition. This, in turn, suggests that the strategic responses in engineering and construction will show parallels with industries ranging from steel to electronics.

Technologically Based Strategies

What, then, are some of the possible strategies? First, and perhaps most obvious, American E&C firms could develop new product offerings for the international market, much as American banks and financial service firms have been doing. Second, they could put more resources into management technologies and construction methods that will reduce costs and improve productivity.

In this industry, most new product development begins with existing technologies that can be applied in new ways—e.g., computer-controlled heating, ventilating, and air-conditioning systems for buildings. Operations and maintenance services provide many other examples; M.W. Kellogg forecasts that 15 percent of its revenues and 30 percent of its gross margins over the next 5 years will come from maintenance and training. In other cases, new industrial processes—and new industries, like biotechnology—mean new opportunities for E&C firms. American companies are attempting to adapt their expertise in chemical process engineering to scale-up in biotechnology. Japanese and German firms, however, may have a head start in bioengineering techniques for the production of specialty chemicals.[26]

O&M services have the great advantage that the work does not end when construction has been completed (although ongoing contracts will normally be small compared to construction contracts). By making use of skills available in the United States—ranging from remote sensing to computer-based process control, production scheduling, and database management —American firms can hope to maintain competitive advantages in contract O&M services. Training local personnel offers complementary opportunities. It may even be possible for American firms to adapt training methods originally developed by the U.S. military; the problems of teaching poorly educated Americans to maintain high-technology military systems are not unlike those of training unskilled workers in LDCs.

U.S.-based E&C firms can also turn their know-how toward renovation and rehabilitation of existing facilities—in part, an extension of the O&M strategy. At some point, equipment becomes obsolescent; replacement, rather than maintenance or modification, will be called for. Particularly for complex industrial plants, many companies look to external contractors when redesign and renovation are called for. Once again, most of the contracts will be small relative to those for new facilities, but opportunities will grow faster.

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[26] *Commercial Biotechnology: An International Analysis* (Washington, DC: Office of Technology Assessment, January 1984), pp. 83-84.

New technologies—mostly originating in other industries—create another set of opportunities for American E&C firms to develop new products. Developments like fiber-optic communication systems or bioengineering stimulate capital investment, with one of the consequences greater demand for E&C services. While many of these opportunities will depend on technical advances beyond their control, E&C firms with the expertise to apply new knowledge should be able to establish competitive margins. Such abilities have been a traditional U.S. strength, but the technology broker strategy will not be as effective in the future as in the past. With other nations—notably Japan—moving into fields like optical communications and biotechnology as rapidly as the United States, it will be harder for American E&C firms to capitalize on new opportunities arising from new technologies.

To be competitive in the future, American E&C firms will probably have to make their own investments in proprietary know-how ranging from control of hazardous wastes to the design and construction of clean rooms for manufacturing integrated circuits. Thus far, international markets for many of these specialized design and engineering projects have been slow to materialize. At some point they will, and the companies prepared to take advantage will reap the rewards.

It will take more than success in developing new E&C products—whether O&M services or knowledge of bioengineering—for U.S. firms to rebuild their competitiveness in engineering and construction. They will need to continue building on their strengths in computer applications and in management, while seeking ways to keep up in construction methods. Expertise in engineering and design gives American firms something to trade: while the United States imports construction technologies, foreign firms come here seeking software and management know-how. So long as they stay ahead in these fields, American E&C firms will have leverage for negotiating joint venture deals and technology transfer agreements. In particular, American companies will need to extend their managerial advantages beyond the large and complex projects in which they excel. With fewer such projects internationally, management skills on smaller and more routine jobs will take on greater significance. There is no reason why U.S. firms should not be able to move from skills in the management of complexity to equal reputations in management for increased productivity and reduced costs. While they have not yet done so, their lead in computer applications gives them a powerful weapon.

Management for productivity and constructability will plainly take on greater importance in the future. With construction know-how widely available to firms in the NICs and LDCs, the grounds for competition will shift from technology itself to the management of technology. In the past, for example, earthmoving in the LDCs depended on cheap labor and simple equipment that relatively unskilled operators could use. Meanwhile, cost pressures in the developed nations led to capital-intensive methods. Contractors turned to very large pieces of equipment, with which a few skilled operators could achieve high levels of output. They also sought specialized equipment for small jobs or for work in congested areas (e.g., laying pipelines). Similar cost pressures lie behind the R&D on automated earthmoving procedures mentioned above—automation that will eventually make it possible for an unskilled labor force to use advanced machinery and equipment. Already, partial automation—e.g., laser-guided grading (box K)—has reduced skill requirements. When companies anywhere can lease or purchase the same equipment, management ability, in the sense of tailoring operations to local conditions, will become a prime source of competitive advantage—one that American firms may still be able to exploit.

The demands of customers and the innovations that emerge elsewhere in the U.S. economy will help shape the future strategies of American E&C firms. In the longer term, the more successful companies will be those willing to invest their own resources in adapting technologies from other industries to the problems of engineering and construction. American firms should be able to do well, given the

U.S. position at or near the forefront of so many technologies, but they *will* have to put money into R&D. E&C firms in other industrialized countries face the same choices and the same opportunities. As in manufacturing, part of the task for U.S. E&C companies will be to more aggressively monitor and learn from their foreign competitors.

International Contracting Practices

American E&C firms enter into international consortia not only to take advantage of the strengths that foreign firms can bring to such ventures, but to meet bidding requirements; U.S. companies contribute management and technical skills, while foreign firms may provide less expensive labor, access to low-interest financing, and their own specialized expertise. A recent example saw Bechtel team with the Japanese firm Kumagai Gumi to build a $170 million dam in Canada.[27] Such arrangements seem bound to increase, given the current realities of global competition.

Among these realities, government intervention looms large: often, the formation of international E&C consortia follows quite directly from government policies that permit foreign participation in local projects only through joint ventures with domestic firms. In this way, governments seek to speed technology transfers—e.g., by requiring that engineering and design work be shared. Where they do not seek joint ventures, governments may require local hiring by foreign contractors. In other cases, domestic firms receive preferences on contract awards—common in industrialized countries as well, where employment has been a primary motive. In the United States, construction projects paid for with public funds have often been restricted to U.S. companies, while Buy American clauses may cover materials and supplies. Canada places restrictions on foreign architects. The United Kingdom requires that engineering contracts for North Sea oil projects go to firms with majority British ownership.[28]

What do government pressures for local participation mean for corporate strategy? Primarily this: any foreign firm that resists government pressures to join with local companies will lose out, in the absence of literally enormous advantages in technology or financing. One or a few foreign firms may decline to participate, but others will be only too happy to take their places. While the United States certainly needs to continue pressing Third World countries to abandon such policies, LDC governments will continue to seek advanced technology in one guise or another—leaving American managers seeking ways of remaining responsive to these requests while also preserving technically based competitive advantages, a dilemma E&C firms share with those in high-technology manufacturing. At the same time, the nature of the international E&C business often makes it necessary to have a local partner, regardless of government involvement.

Beyond entering joint ventures and consortia with foreign companies, American E&C firms have begun to explore joint development with manufacturing firms as a route to proprietary technologies and possible competitive advantages. For example, Bechtel and Varian Associates have combined to supply clean-room facilities for the microelectronics industry, while Fluor has joined with the Allen Group to offer a package of services for the design and construction of automated factories. Although these efforts are in their early stages, they will probably expand in size and scope. If hard-pressed American firms in several industries can join, taking advantage of the technical positions that each retains, they should fare better internationally. For the E&C industry, these joint endeavors suggest somewhat belated recognition that a continuing technological edge depends on advances in other sectors of the U.S. economy.

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[27] Japanese financing was part of the original aim. While this did not work out, the project nonetheless proceeded—"U.S.-Japanese Team Speeds Canadian Dam," *Engineering News-Record*, Oct. 23, 1986, p 20.

[28] J. Randolph, "Foreign Government Targeting of Engineering-Construction Services," memorandum, Department of Commerce, Washington, DC, February 1986.

In preparation for the Uruguay Round trade negotiations, the U.S. Government has compiled a long list of violations of national treatment—the principle that domestic and foreign firms be treated the same—in the awarding of E&C contracts. See "Trade Issues in the Engineering and Construction and Related Consultancy Services Industry," background paper, Office of the United States Trade Representative, Washington, DC (no date).

Many in the U.S. E&C industry have strong reservations concerning the new trade round. Managers fear the United States may back away from current policies that support the industry—e.g., preferences and set-asides on foreign projects such as military bases—in exchange for liberalization elsewhere. The industry opposes the extension of the CATT procurement code to engineering and construction services for similar reasons.

Finally, American firms have the option of eschewing international markets entirely, and retrenching inside the Nation's borders. Although the size of the U.S. market makes this option potentially attractive, the choice is a risky one, as the experiences of American manufacturing corporations demonstrate. While foreign penetration of U.S. construction markets has thus far been minor relative to the overall size of the industry, firms in Japan and Europe clearly see in the overseas problems of American contractors evidence of vulnerability at home. With foreign E&C companies making penetration of the U.S. market a major element in their own strategies, American firms that pull back internationally may quickly find the competition following them here. So long as the U.S. economy remains a relatively open one, the home market will not necessarily be a safe haven for American E&C firms.

Moreover, abandoning the international market carries implicit costs. First of all, reentry in later years—e.g., when the world economy has picked up—will be difficult. Reputations will be tarnished if not lost, along with critical stores of overseas experience. Mobilization of resources will be difficult once foreign bases have been abandoned; companies will face new expenses. Furthermore, a corporate view limited to the United States could cause E&C firms to overlook potential sources of competitive advantage valuable, not only in international competition, but at home—e.g., technologies pioneered overseas. Again, the analogy with U.S. manufacturing, where many purely domestic companies remain ignorant of foreign innovations, seems appropriate. Today, a provincial view of technology development is an invitation to competitive obsolescence. And ultimately the real worry is that inability to compete abroad may foreshadow inability to compete at home.

POLICY ISSUES: TECHNOLOGY DEVELOPMENT AND DIFFUSION

As earlier sections of this chapter suggest, the major policy issues for the U.S. E&C industry center on financing and technology. When it comes to financing, success in U.S. efforts to combat foreign government subsidies would be a major step toward equalizing the terms of competition. The Export-Import Bank's Engineering Multiplier Program, through which the bank extends loans to foreign purchasers of U.S. architectural and engineering services, has also provided some help, as has the Trade and Development Program. Chapter 10 discusses these and other topics related to financing, including specific policy options. This section focuses on technology.

As noted earlier, U.S. E&C firms do little R&D. Most of the support for research related to construction comes from the Federal Government (box L), from suppliers to the industry, and from the owners of large facilities. There are no authoritative figures on total U.S. expenditures for construction R&D, but spending is probably in the range of half a percent of construction revenues; Japan's construction R&D, in contrast, has been put at 3 percent of total industry revenues.[29] Not only is spending in the United States low, but the military focus of federally supported R&D contrasts sharply with the typical approach in Japan and Europe. Many European governments have ministries of construction. Among their other activities, these ministries sponsor and coordinate R&D. In the United States, as box L indicates, the Department of Defense accounts for most government R&D related to construction. Much of the money goes toward the water and port projects of the Army Corps of Engineers; technology

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[29] R. Tucker, "CII Project Overview," presentation to the First Construction Industry Institute Annual Meeting, Keystone, CO, Aug. 7, 1985, p. 4.

Box L.—Federal Government R&D Support for Construction-Related Technologies

While a good deal of Federal support goes toward technologies tangentially related to the E&C industry—e.g., new materials, robotics and automated manufacturing—directly relevant work outside the military totals less than $30 million per year. Spending by the National Bureau of Standards (NBS, part of the Department of Commerce) accounts for about $20 million of this total.

Civilian Agencies

The fiscal year 1987 budget for the NBS Center for Building Technology (CBT) comes to $12 million. The Center for Fire Research, also part of NBS, gets another $8 million. (Both figures include work undertaken on a reimbursable basis for other agencies.) In past years, the Reagan Administration has sought to eliminate both NBS centers, arguing that their activities could be undertaken by State and local governments; the current Administration proposal for fiscal year 1988 calls for merging the two centers and reducing funding.

Consistent with NBS's overall mission, the CBT develops measurement techniques, databases, and testing methods—a set of technologies with broad and general relevance to the construction industry. Because of this, support at State and local levels seems unlikely. Why should one State pay for R&D that the other 49 will also benefit from? Although Congress has kept the CBT's programs going, funding has declined from a high point of $14.7 million in 1980 to the 1987 level of $12 million, while man-years have fallen from 199 to 126 over the same period. With two-thirds of the Center's work undertaken on a reimbursable basis for other organizations (mostly government agencies), a continued decline in direct appropriations means that more of CBT's research will reflect the narrow missions of these agencies. Congressional appropriations—some $3.4 million in 1987—provide most of the support for generic R&D at the Center.

The National Science Foundation (NSF) funds construction-related research in civil engineering, almost all of it at universities. Three programs account for most of the relevant NSF grants. The Structures and Building Systems program funds research on construction processes, including automation, at a 1987 level of $3.8 million. A program focused on infrastructure and on existing buildings, entitled Systems Engineering for Large Structures, has a 1987 budget of $2.7 million. NSF's Earthquake Hazards Mitigation program ($14.4 million) funds some R&D related to construction. In addition, NSF has awarded a grant for an Engineering Research Center on Advanced Technology for Large Structural Systems to Lehigh University; this center is scheduled to receive $10.4 million over 5 years, with additional support from the Pennsylvania State Government.

Finally, the Federal Highway Administration spends something less than $1 million per year on research, development, and technology transfer related to highway pavements and bridges. Some State highway departments also maintain research programs. Currently, the National Research Council's Transportation Research Board is coordinating the Strategic Highway Research Program, with a 5-year budget from several State and Federal organizations of $150 million. About half the budget will be spend on materials-related research; little will go to R&D on construction processes.

Defense-Related R&D

Military projects at six Federal laboratories run to much higher levels—a total of about $270 million in 1986. The Army maintains a combat engineering laboratory at the Belvoir Research and Development Center, while the Army Corps of Engineers operates three facilities—the Construction Engineering Research Laboratory, the Cold Regions Research and Engineering Laboratory, and the Waterways Experiment Station. The total R&D budget for the Corps of Engineers came to $67 million in 1986, with 1987 estimates of $62 million to $75 million. The Air Force and the Navy each maintain civil engineering laboratories of their own, while the Department of Defense began in 1986 to fund Centers of Excellence on Advanced Construction Technology at MIT and the University of Illinois.

Some, though not all, of the military research is relevant to civilian construction problems—most commonly, the work of the Army Corps of Engineers, which is responsible for heavy construction on many U.S. dams and waterways. But work that *could* be used in the civilian E&C industry finds its way only slowly and sporadically to the one million-plus American E&C firms.

transfer from the Corps' laboratories to industry has been occasional.

The analysis in earlier sections of this chapter indicates that, to be competitive in the future, U.S. E&C firms will have to rely heavily on advanced construction technologies. Over the next several decades, construction will gradually emerge as a high-technology industry, with extensive automation replacing the craft-based methods in current use. Rapid productivity gains will cut costs for firms that lead in *applications* of high technology; the need is as much for creative use of tools and techniques that already exist (perhaps in embryo form) as for new research. At present, American firms do a good job of applying computer-based technologies during the design stages of E&C projects, and for construction management, but they are well behind in construction methods, automated and otherwise. That is where most of the costs are incurred, and where the big payoffs lie.

That future international advantages for the U.S. E&C industry will be based in part on technology could, in itself, justify higher levels of Federal funding for construction research. But the potential domestic impacts—through greater productivity and lower costs for projects ranging from residential building through infrastructure improvement (roads, waterworks) to heavy construction—argue much more powerfully for higher levels of R&D. But why should government pay? Because much of the work required falls in the category of generic or precompetitive R&D. For reasons explored in greater detail in chapter 6, private firms in the United States seldom pursue such R&D very extensively. Simply put, no one firm can expect to capture the rewards from R&D that benefits an entire industry.

For the U.S. construction industry, the immediate opportunities lie in utilization of existing knowledge, including technology from other industries and know-how originating overseas (e.g., European approaches to reinforced concrete construction). Institutionally, perhaps the most pressing need—given the vast size and fragmented character of the industry—is for better-developed mechanisms for diffusing technology, and the lessons of experience in applications of new technologies.[30]

Again, note the parallels with U.S. manufacturing. The Nation's base in scientific research and in high technology is unmatched in the world. Much of this research, in principle, can be applied to industrial problems. But relatively few of the firms, in construction or in manufacturing, that might draw on this research base have staffs capable of picking and choosing what is needed for a particular problem. Nor do that many firms have the strategic vision at executive levels necessary for reshaping their operations over periods of years (which would include recruiting and training the right kind of employees) to take advantage of new technological opportunities. Such difficulties exist around the world. But particularly in the United States—where the gap between advanced research and applications is widest—attempts at technological solutions to problems in either construction or manufacturing too often fail because of a mismatch between the company's real needs and the means brought to bear (technology for the sake of technology), because of an inappropriate mix of people and machines (integrating the work force out of the process rather than into the process), or for lack of commitment (management backs out after initial failures, rather than seeking to learn from experience). In essence, U.S. E&C firms have not been very good at appropriate technology.

A positive Federal role, then, would be to help create infrastructural mechanisms for: 1) conducting R&D on construction methods; and 2) transferring know-how and results to the E&C industry, in part through ongoing company involvement in the R&D projects themselves. NSF's Engineering Research Centers provide a possible model (although one center for construction might fill 1 percent of the need); other models also exist, both here and overseas.[31] Given the size of the E&C industry, and the range of applicable technologies (including those originating in other industries), a robust and self-sustaining infrastructure for developing and transferring construction-related technologies might involve dozens of such centers.

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[30] Poor attendance at meetings on technology transfer organized by military laboratories that conduct construction-related R&D shows, not that there is no problem, but how deep-seated the problems are—"Military R&D Up for Grabs," *Engineering News-Record*, Mar. 6, 1986, p. 11.

Certainly there appears to be room for one or more industry-cooperative R&D consortia on the lines of Microelectronics & Computer Technology Corp. The Federal Government could facilitate the creation of such consortia by contributing seed money and/or incorporating some of the ongoing activities of the existing NBS Center for Building Technology. Furthermore, ongoing Federal funding of some percentage of the work conducted by R&D consortia could serve the public interest. For example, government support for testing and commercialization of new construction technologies would help ensure the safety and long life of structures built with public funds. (NBS, the Federal Highway Administration, and the Army Corps of Engineers do some of this already.)

Government agencies might also help speed innovation by experimenting with contract procedures that would permit bidders to propose alternative techniques, following the European model, to be evaluated by an independent board of experts. Alternatively, government agencies could move toward design-build contracts, or greater use of performance-based specifications. Congress has already directed the Department of Defense to pursue nontraditional approaches to construction projects in an effort to reduce costs.[32] Related needs and mechanisms range from a national system for information exchange on construction technologies to upgraded teaching equipment in trade schools and university engineering departments.[33]

CONCLUDING REMARKS

Into the 1970s, developing countries looked to U.S.-based E&C firms to design and build electric generating plants and power distribution networks, refineries and petrochemical complexes, pipelines and offshore oil platforms, steel mills and cement plants. American companies, with a great deal of experience from work in the U.S. energy industry, were able to transfer their skills quite directly to competition for international projects in the Middle East. In the poorer LDCs, much of the work consisted of infrastructural development, often financed by international lending agencies. Here, U.S. advantages were based on domestic experience with large water and highway projects and on political and economic ties with Latin America.

These once comfortable patterns have broken down. In part, the shrinking U.S. share of international markets has been a consequence of Third World debt and declining oil prices. So long as developing countries face demands for austerity programs to qualify for additional loans—often needed simply to service their debt—new construction undertaken by outsiders will be the exception rather than the rule.

But much more is at work than the credit crunch and declining oil revenues. E&C firms in the developing world have themselves matured technologically; taking advantage of low labor costs, they can now win some kinds of contracts in competition with companies based in the advanced nations. Government policies in the LDCs and NICs have helped the process along. Viewing construction as a vital industry for development, governments have protected local entrants and forced international contractors to enter joint ventures and transfer technology. And when it comes to construction methods, American contractors generally lag behind competitors in Europe and Japan, while typical U.S. contracting procedures discourage innovation. With financing a major element in winning new contracts, and a troubled world economy, competition will remain stiff, and the U.S. share of E&C markets will probably continue to decline.

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[31] See "Development and Diffusion of Commercial Technologies: Should the Federal Government Redefine Its Role?" staff memorandum, Office of Technology Assessment, Washington, DC, March 1984.

[32] *Military Construction Appropriations Bill, 1987*, Report 99-648 to accompany H.R. 5052, Committee on Appropriations, House of Representatives, June 19, 1986, p. 13.

[33] *Technology and the Future of the U.S. Construction Industry*, Proceedings of the Panel on Technical Change and the U.S. Building Construction Industry, Office of Technology Assessment and the American Institute of Architects (Washington, DC: AIA Press, 1986), p. 75.

Nor can the U.S. industry afford to feel that its current lead in management expertise will be secure. With O&M contracts accelerating the spread of expertise, any strategy based on superior managerial skills will probably fail unless complemented by a major effort to make up lost ground in construction technologies. Indeed, U.S. firms need to catch up in construction know-how simply to protect their domestic markets from foreign incursions.

Today, the competitive environment facing American E&C firms resembles that for many manufacturing companies. Some E&C firms have reacted much like those manufacturers that have called for government assistance while retrenching or withdrawing from international markets. But reactive strategies will not rescue this industry, although government preferences and set-asides might help provide needed cash flow (while also meaning higher construction costs for Federal agencies). On the other hand, those American firms that take the initiative in technology development, and in tapping the skills of U.S. financial institutions, will—when they cannot win projects on their own—often be able to enter international consortia and joint ventures on favorable terms. Certainly, these international combinations will become more common; to the extent that such consortia become standard features on the competitive landscape, firms that can bring distinctive advantages to them will do better, while those that cannot will lose ground.

Relatively few American E&C firms are active in the international market, and loss of competitive advantage internationally, in and of itself, would not be a devastating blow to the U.S. economy. Greater dangers come from possible losses of downstream sales by suppliers of materials and equipment. While exports of American E&C services do not automatically translate into exports of goods, such linkages continue to benefit the Nation's balance of payments, as well as U.S. employment. By encouraging the formation of cooperative ventures between E&C companies and other American firms—e.g., trading companies—the Federal Government could help strengthen these linkages. Team America, a consortium assembled to bid on China's huge Three Gorges project offers a suggestive model (the group includes U.S. E&C firms, suppliers, and banks).

In terms of Federal policies, however, the greatest short-term need is simply to force other OECD nations away from subsidized financing for international projects. For years, the major industrial economies have used export credits to sweeten deals, particularly those with developing countries. When it comes to E&C projects, most of the industrialized nations offer generally similar development assistance and export credit packages. Several of the NICs, notably South Korea, also provide financing assistance to support their E&C industries.[34]

Once some governments began offering subsidized financing packages, others followed suit to avoid losing sales. While an agreement within the OECD (see ch. 10) established consensus interest rates on loans, with lower rates and longer maturities on credits for the poorest developing countries, the agreement did not cover tied aid or mixed credits, leaving a loophole exploited by France and other European nations, along with Japan. Congress approved a $300 million mixed credit war chest in 1986, with the intent of creating leverage for negotiations aimed at moderating the use of mixed credits by other nations. A revised OECD agreement, in the spring of 1987, promises to be a step in the right direction. But the United States will probably have to keep the pressure on.

Over the longer run, Federal support for innovation and technology development carries the greatest promise for helping this industry rebuild its competitiveness. Currently, American E&C firms do almost no R&D. Meanwhile, the larger European companies have many years experience in turning proprietary construction technologies to competitive advantage. Precasting, pre-stressing, and post-tensioning techniques for concrete, for instance, have been developed mainly in Europe.

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[34] In addition, South Korea's Government offers tax incentives to encourage R&D by construction firms—W. Arnold, "Rescue Package for Construction Sector," *Development Forum*, June 17, 1985, p. 1.

Given the continuing inability of American companies to compete on costs for routine international projects, successful strategies will necessarily entail technological leadership beyond that already achieved in design and management. American E&C firms are in much the same position as countless manufacturing companies. Without strenuous and continuing efforts in R&D and technology development, U.S. contractors can look forward, first, to further deterioration of their competitive positions abroad. This will almost inevitably be followed by an increase in competitive pressures at home. The pattern has long since become clear in other industries.

Renewed technical leadership will depend in considerable measure on developments elsewhere in the U.S. economy. Much as they have done in the past with computer-assisted construction management techniques, E&C firms will have to draw on other American industries in building proprietary technical positions. Most of these companies have avoided strategies based on proprietary technologies in the past. For that reason alone, long-term efforts will be necessary.

Future international success will probably also require more diversification than American E&C companies have preferred. Narrow expertise tied to the energy industry or to power generation carries high risks in a period of slow economic growth and volatile energy prices; specialized firms will be vulnerable to both cyclical (or secular) decline in their clients' industries, and to the competitive thrusts of targeted policies by foreign firms and foreign governments. Diversification can reduce the vulnerabilities only too evident over the past few years among E&C firms that depended heavily on energy projects.

While new corporate strategies are evolving in some American E&C firms, old habits will die hard in others; for those in the latter camp, international competition will be harsh and potentially devastating. Many companies still appear at sea, unable to home in on new strategies suited to new competitive conditions. While some U.S.-based E&C companies have begun to place more emphasis on R&D, they are in the minority. Those that aggressively seek and adapt technologies from other industries, and from foreign E&C firms, will be better positioned to gain with respect to competitors both at home and abroad. Eventually, prefabrication and automation will be common in the construction industry. Productivity will jump. If American firms take the lead in developing new approaches to construction methods, they may be able to renew their competitive ability internationally. If they fail, their markets within the United States could be deeply penetrated by able foreign competitors.

Chapter 5

Information Technology Services:

Software, Telecommunications, Data Processing, and Information Services

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Chapter 5

Information Technology Services:

Software, Telecommunications, Data Processing, and Information Services

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SUMMARY

The cliche comes easily: information technology is to modern industrial societies what steel was to the industrial societies of the late 19th century, automobiles to the first half of the 20th. Computer hardware and software, telecommunications, embedded and invisible processors deep inside other equipment—these aid banks in processing huge flows of transactions, make factories more productive, help airplanes fly. The logic built into software tells the processors what to do, while telecommunications systems permit computers as well as people to talk to one another over thousands of miles.

This chapter deals not only with software and telecommunications, but with marketed data processing and information services. The cluster of industries covered—the information technology (IT) services—includes both new applications (database services and videotex, defined below) and businesses that are already relatively mature (data processing). All depend on the ability to store, process, and transmit great volumes of information at ever-lower costs.

Software, something like a service (computer programs have no necessarily fixed form) and something like a good (programs can be reproduced, stored, and shipped) makes the rest of the IT services possible. All the products of digital systems technologies depend on computing capability in one way or another, and computing capability depends on software. Today, for instance, the central switching systems that route telephone calls between distant cities are giant computers; 80 percent or more of the $2 billion-$3 billion cost for developing a new generation of these central office (CO) switches goes for software.[1] Software development costs are likewise becoming a larger proportion of total development costs for both microprocessors and their embedded applications. Very large-scale integrated circuits, the building blocks of computers and communications systems, can only be designed using software for computer-aided design; the same is true of computers themselves. Software, which embodies the logic of complex systems, epitomizes high technology for the latter part of the 20th century.

While computer hardware manufacturers (and users) continue to develop a great deal of software, a rapidly growing independent industry had emerged by the 1970s. The firms in this industry develop and market programs for off-the-shelf sale or lease to customers—packaged software—along with custom products tailored to user requirements. Generally the software company will also provide training, documentation, and at least some software maintenance; over the life of a package, maintenance costs—e.g., updating and error correction—may exceed the cost for developing the original program by several times.

In 1985, U.S. firms had about 70 percent of a world software market worth some $30 billion, with many of their overseas sales through affiliates.[2] The largest portion of these revenues come from the sale of operating systems and applications software for large mainframe computers—much of this software supplied by the original equipment manufacturers—but sales of software for small systems, notably PCs, have been growing rapidly. An applications package for a large system can easily cost $1 million, while many PC programs retail for under

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[1] J. Rippeteau, "GTE's Planned Link With Siemens Worries Customers," *Financial Times*, Apr. 22, 1986, p. 18.

Companies producing CO switches can expect to spend several hundred million dollars annually simply on maintaining and improving the software, particularly on software updates for providing new services.

[2] *1986 U.S. Industrial Outlook* (Washington, DC: Department of Commerce, January 1986), p. 28-3.

$100. The custom software business consists largely in putting together complex and specialized applications packages for relatively powerful machines.

U.S.-based firms have been market leaders for a long time, but their share of the world market seems bound to shrink in the years ahead. With much of the future growth in other countries, where computer use does not come near to levels now common in the United States, foreign software firms will probably be able to improve their relative positions, particularly as they follow the American lead in switching to packaged, as opposed to customized, software. In particular, the U.S. industry can expect a strong challenge from suppliers in Japan, as that country continues to build its computer industry. With software increasingly influencing or determining the design of hardware, the Japanese realize they need major advances in software; both government and industry have made strong commitments to improvements in software productivity and to new generations of software technology, with the goal of leapfrogging the United States.

Providers of *telecommunications services* give their customers access to an infrastructure of public switched telecommunications networks, along with private leased lines for voice and/or data communications. Developments including microwave systems, communications satellites, fiber-optic links, cellular telephones, and cable TV networks have made possible not only new services—e.g., videotex—but conventional voice and data transmission bypassing the regular telegraph and telephone network. One of the newest elements in this evolving infrastructure, local area networks (LANs), link computers within an office, a building, or similarly restricted setting, while wide area networks (WANs) tie together systems that may be on different continents.

Over the next several decades, many countries will begin building Integrated Services Digital Networks (ISDN) that can handle voice, data, facsimile, and video signals over a common grid—a development that promises rapidly declining costs for transmission, although the worldwide capital costs of building ISDN networks will run into the hundreds of billions of dollars. New services will be possible, if only because most data communications still move over telephone lines, which were never intended for this purpose; ISDN will be much faster, and, for a given volume of data, much cheaper. Choice of technologies for ISDN both internationally and within the United States will have far-ranging impacts on competitiveness (chs. 9 and 10). Should the United States find itself with an ISDN system different from the rest of the world, or with several different ISDN systems, American firms in many industries could be placed at a competitive disadvantage.

Technological changes over the past two decades have already had major impacts on the competitive environment in the United States. Microwave transmission made it possible for new entrants to challenge AT&T's monopoly on long-distance telephone service. MCI and other companies prevailed in the courts and later in Congress, arguing that competition would provide better service, stimulate innovation, and avoid the regulatory confusion stemming from the blurring of boundaries between voice and data communications. The series of administrative, judicial, and congressional decisions establishing the right of other firms to offer services through the AT&T network culminated in the breakup of the Bell System, a process that has had enormous impacts worldwide.

Domestic telecommunications revenues greatly exceed the value of international services; in 1986, only $3.6 billion of U.S. revenues estimated at some $117 billion represented international telecommunications services.[3] Although Japan, and to some extent Great Britain, have begun to follow the U.S. lead in deregulation, telecommunications remains a government monopoly in most countries, with little opportunity for competition in traditional telephone and telegraph services. Rather, most of the international opportunities lie in network services that add value to data communications by providing file storage, message switching, protocol conversion, interfaces for different types of terminals, and access to database and other information services. Value-added networks (VANs) providing some or all of these functions, mostly to business customers, have grown rapidly. While maintaining tightly regulated basic telecommunications markets, a number of countries have moved to liberalize value-added services provided over the public infrastructure, enabling American firms to compete in some VAN markets abroad.

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[3] *1987 U.S. Industrial Outlook* (Washington, DC: Department of Commerce, January 1987), p. 31-1. Negotiated formulas divide the charges for international services between the carriers in the countries involved—*Trade in Services: Exports and Foreign Revenues* (Washington, DC: Office of Technology Assessment, September 1986), pp. 91-94.

In effect, almost any computer network can be viewed as a VAN—the SWIFT (Society of Worldwide Interbank Financial Telecommunications) system for electronically linking banks described in chapter 3; airline reservation systems (some 50,000 terminals in 12,000 travel agency offices worldwide are tied into American Airlines' Sabre system); even ARPANET, designed for the U.S. Department of Defense in the 1960s to link computers in R&D laboratories, and the original source for much of the technology used in current computer and communications networks.[4]

Videotext/teletext services, known collectively as videotex, consist essentially of VANs providing access to multiple information services; examples include The Source and Dow Jones Information Retrieval, which offer a variety of personal and business information services, including electronic mail, stock market quotations, and airline directories. (Videotext and teletext differ primarily in that videotext services tend to be highly interactive, and to be provided over the telephone network, while teletext is broadcast to television receivers.) Originally targeted at households, videotex services have also sold well to businesses. Outside the United States, government PTTs (post, telegraph, and telephone authorities) or other monopoly telecommunications carriers have generally supplied videotex services; the most successful has been the French Teletel/Minitel system, with 2½ million terminals in service at the end of 1986 and 6 million projected for 1990. Monopoly control of videotex services in other countries will limit the ability of U.S. firms to compete, but they may be allowed in when they have specialized services to offer that would otherwise be unavailable.

Firms providing *data-processing* (DP) *services* were among the first to take advantage of the telecommunications infrastructure for transmitting digital data. Starting with batch processing, when data were physically transferred (e.g., as coding forms or on magnetic tape) to a facility owned by the processor, DP services quickly expanded into remote processing, with data transferred via telephone lines. DP services firms sell computer time (including time on supercomputers), handle payrolls and accounting for other companies, and in many cases provide facilities management under contract; systems integrators help customers design their own DP facilities (e.g., choosing and packaging hardware and software). OTA places the 1984 foreign revenues of U.S. DP services firms at $2.7 billion to $5.1 billion, while total revenues, domestic plus foreign, came to about $15 billion.[5]

DP services firms grew rapidly by providing computing capability to companies that did not have equivalent internal capabilities; today, with computing power cheap and widespread, this part of the business is mature. While DP services firms can still provide many specialized functions cheaply, growth will come in new lines of business; many DP services companies are now pursuing strategies that emphasis VANs or information services.

If growth in the DP services industry has slowed, *information services* and electronic databases are poised for rapid expansion. In essence an old industry taking on a new form, electronic databases can supplement and extend print media in many ways. Information ranging from bibliographic citations to the text of legal decisions to remote sensing data gathered by satellites can now be delivered to the customer on a floppy disk or directly over the telecommunications infrastructure. U.S. information services firms had 1985 revenues of about $1.9 billion, with 20 percent coming from foreign sources; American vendors supply half or more of all database services in Europe.[6] American companies have also had considerable success in Japan; with English in nearly universal use among business customers, the U.S. industry will have a continuing source of advantage in international competition.

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[4] On Sabre, see S. Carey, "Europe Bristles at U.S.-Airline Computers," *Wall Street Journal*, Nov. 21, 1986, p. 36.

[5] *Trade in Services: Exports and Foreign Revenues*, op. cit., p. 62.

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[6] *1986 U.S. Industrial Outlook*, op. cit., p. 48-6.

Much of the information in the rest of this chapter not otherwise cited comes from interviews.

COMPUTER SOFTWARE

In the early years of the U.S. computer industry, customers purchased hardware and software bundled as a package from one of the half-dozen or so companies that made computing equipment. Customers could create their own applications software, but normally relied heavily on programming languages and implementation routines developed and supplied by the manufacturer. As early as the 1950s, independent software and systems houses emerged to meet specialized programming requirements. Through the 1960s, as user needs became more specialized, independent firms continued to expand.

A major turning point came in 1969. IBM, already the largest computer manufacturer in the world by far, was forced under intense antitrust pressure to unbundle software, changing its pricing policy so that customers were charged separately for hardware and for programs. The independent software industry gained new credibility, while more customers began to evaluate software purchases independently of hardware. For the smaller computer firms striving to compete with IBM, and particularly the emerging manufacturers of minicomputers, such as Digital Equipment Corp. (DEC), this was an important development. DEC still markets 30 to 40 percent of its hardware to systems houses which assemble integrated hardware/software packages to the specifications of particular customers.

Many businesses continue to do some of their own programming. Banks and accounting firms, for example, maintain large staffs of computer specialists. But for relatively standardized needs, the benefits of purchasing software on the outside, particularly packaged software, have become steadily more compelling. These benefits include:

- *Availability.*—Software already on the market can be quickly evaluated, purchased, and put to work.
- *Lower Risk.*—A firm choosing to develop its own programs may not achieve its functional goals; even if it does, the development effort may cost more and/or take more time than planned.
- *Manpower Savings.*—Purchasing software minimizes the company's internal staffing requirements.
- *Better Documentation.*—Packaged software includes documentation, which can be evaluated as part of the purchase decision. Few companies that do their own programming seem able to enforce high priorities for documentation.[7]

Against these points, a company must weigh the prospects of arriving at better solutions to its particular problems. It must also consider the possible strategic advantages (ch. 8); unique software can, like other forms of proprietary technology, be a potent competitive weapon.

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[7] W.L. Frank, *Critical Issues in Software* (New York: Wiley-Interscience, 1983), p. 166.

Fourth-generation languages, which make it easier for end users with relatively little training to create their own applications packages, sharpen the trade-offs between in-house and off-the-shelf software. Also called end-user-oriented packages, examples of fourth-generation languages include FOCUS (Information Builders Inc.), ADABAS (Software AG), and Ramis-II (Martin Marietta).[8]

Hardware and Software Costs: Productivity in Software Generation

Cost/performance ratios for computer hardware have been declining steeply for years, with no end in sight; today, even the smallest businesses can easily buy and use surprisingly powerful desktop machines. More than ever, purchase decisions for hardware—small systems and large—depend on software availability. Indeed, software has begun to dictate the design of hardware. Computer manufacturers find themselves spending the majority of their R&D dollars on software. Given the decline in prices for equipment, they seek to increase their revenues from software sales; at IBM, software and services have grown from less than 20 percent of total revenues as recently as 1983 to about 30 percent in 1986.[9]

Falling hardware prices, leading to a larger user base, increase the demand for software. This, in turn, means that software suppliers can charge lower prices because they can amortize their upfront development costs over larger unit sales. But at the same time, productivity in developing software has increased only slowly—perhaps 5 to 10 percent per year, far less than rates of productivity increase on the hardware side of the business. Skilled programmers must still write and debug software on a line-by-line basis. While improvements in computer languages and programming aids, including automation, have helped, longer and more complex programs continue to stretch the capabilities of the best people and the best tools. Software maintenance—upgrades as well as debugging—typically accounts for well over half of life-cycle software costs.[10] Documentation is also expensive, while the spread of computing power to new and nonexpert users has made good documentation ever more important for success in the marketplace. The result? A productivity bottleneck in programming, with software now accounting for a far greater percentage of total system costs than in earlier years.

With demand for skilled programmers and systems developers high, American universities have struggled for a decade to keep up, as more and more students sought to study computer science and software engineering. While some kinds of routine software development can be handled by programmers with modest skills, marketplace success often depends on the insights of a few unusually creative people —those who can devise a fourth-generation language, make progress in automating the generation of software itself, or develop expert systems (a form of artificial intelligence, or AI). The growing dependence of hardware design on software places still heavier demands on the conceptual skills of those responsible for the overall design of software packages.

Given the dimensions of the productivity bottleneck, a great deal of software R&D has been directed toward tools for cutting costs and speeding common programming tasks. In the near term, fourth-generation languages, which can give 10:1 to 100.1 productivity improvements, seem to offer the best hope. Related efforts in the United States include AI techniques for training programmers, as well as expert systems to help them generate new software.

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[8] On the advantages of fourth-generation languages, see J. Martin and C. McClure, *Software Maintenance: The Problem and Its Solution* (Englewood Cliffs, NJ: Prentice-Hall, 1983), ch. 11, also J. Martin, *Fourth Generation Languages* (Englewood Cliffs, NJ: Prentice-Hall, 1985). With a third-generation language like Basic or COBOL the programmer's instructions tell the computer in step-by-step fashion how to proceed. With a fourth-generation language, the (applications) programmer tells the system what the output should be, but not how to achieve that output.

[9] M. Schrage, "IBM Reprograms Its Strategy to Sell Software, Services," *Washington Post*, Aug. 3, 1986, p. F1.

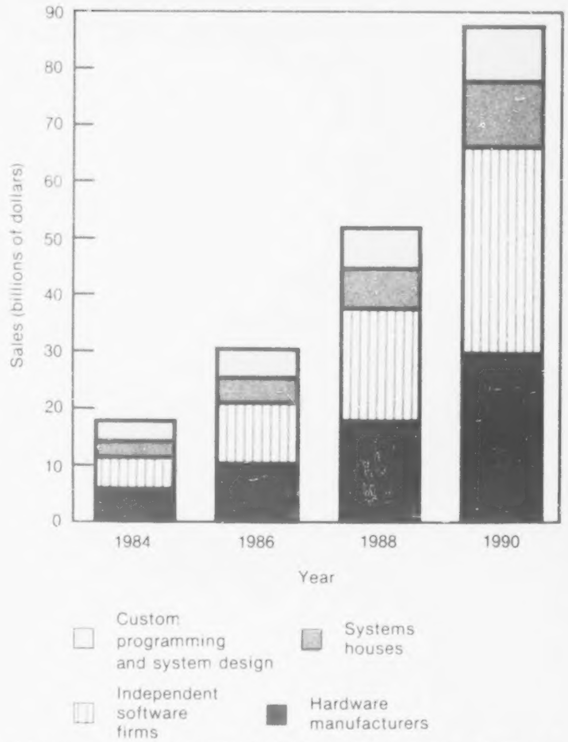
[10] Some estimates indicate that as much as 80 percent of maintenance costs go toward adapting software to customer needs that were not fully understood when the development process began, or that have shifted over time. See *Software Maintenance: The Problem and Its Solution*, op. cit., p. 4. For an idea of the scope of maintenance requirements, note that the worldwide inventory of programs written in COBOL, still popular for business applications, reaches perhaps 75 billion lines of code—"Engineering an End to the Software Nightmare," *Financial Times*, Nov. 20, 1986, p. 14.

The U.S. Industry

The American software industry is the largest in the world and the biggest exporter. U.S.-based firms reportedly hold more than 70 percent of the global software market, with worldwide revenues of about $21 billion in 1985.[11]

As many as 10,000 American firms, the vast majority quite small, develop and market computer software. As figure 33 shows, in recent years hardware manufacturers and independent software firms have accounted for roughly equal sales volumes, with projections suggesting that the share of the independent firms will grow. Contract programming is expected to drop from over 20 percent of the market currently to a projected 12 percent, a consequence of the continuing trend away from custom software.

Figure 33.—Projected Worldwide Revenues of U.S.-Based Software Suppliers



SOURCE: "Review and Forecast: The Software and Services Marketplace," International Data Corp., March 1985.

Most of the software supplied by hardware manufacturers consists of operating systems and applications software—e.g., for database management—designed specifically for the firm's machines. This is a big market in dollar terms: while mainframes and minicomputers sell in the hundreds or thousands to tens of thousands of machines per year, compared with millions of PCs, software for the more powerful systems costs much more. The sales of the largest of the independent PC software firms, Lotus Development, came to about $225 million in 1985; IBM's software revenues totaled $4.2 billion, and Hewlett-Packard's $500 million.[12]

With few exceptions, foreign firms lag well behind their American competitors in software technology, as well as in sales. The factors responsible for U.S. leadership begin with the vast domestic market, driven by a hardware base that is the largest in the world by far. American software firms can expect to cover their design and development costs at home, giving them latitude in setting prices overseas. Because even a product that is not a great success may sell enough copies to cover fixed costs,

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[11] *1986 U.S. Industrial Outlook*, op. cit., p. 28-3. Western Europe, Canada, and Australia have been major markets for U.S.-based firms.

The most recent figures on market share, for 1982, show the U.S. industry far ahead of other national software industries:

	Sales (billions of dollars)	*Employment*	*Percent foreign sales*	*World market share*
United States	$10.3	224,000	50-60%	70%
France	1.3	40,000	24	5-7
Japan	1.2	38,000 +	1	5-7
United Kingdom	0.7	25,000 +	7	2-3

See *A Competitive Assessment of the U.S. Software Industry* (Washington, DC: Department of Commerce, December 1984) p. 35; the employment figure for the United Kingdom comes from *Policy for the UK Information Technology Industry* (London: National Economic Development Office, 1982), p. 61.

The expert systems market is currently in the $140 million range—J. Moad, "Building a Bridge to Expert Systems," *Datamation*, Jan. 1, 1987, p. 17.

[12] P. Archbold and P. Hodges, "The Datamation 100," *Datamation*, June 15, 1986.

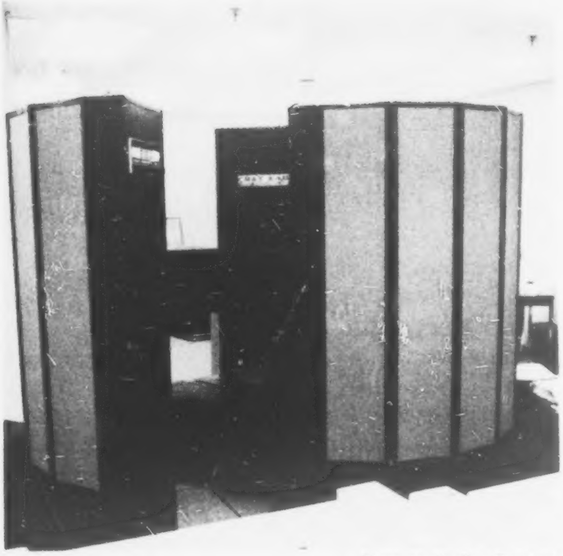

Photo credit: Cray Research

Cray X-MP supercomputer, one of the most powerful machines available.

the risks of new product development are lower here than in foreign countries—one reason why foreign firms like Software AG have invested heavily in the United States.

While all signs point to continued competitive strength for U.S. suppliers, their world market share seems bound to slowly decline. Foreign industries where custom programming is still the rule will be forced, sooner or later, to move into the design and production of standardized software. As firms overseas negotiate this transition, some will emerge better able to compete with American suppliers.

Japan's Software Industry and Market

While European software firms have been more visible internationally than the Japanese, over the longer run Japan will emerge as the primary U.S. competitor in software. Today, the major Japanese computer manufacturers sell hardware that compares well with that from American firms. But Japan remains substantially behind in software, with poor applications packages—along with limited sales and service networks—a major handicap in selling hardware internationally, particularly in the office automation and PC markets. In contrast, Japanese systems software, which is based on technology originating in the United States, is usually considered to be quite good.[13]

The Japanese recognize their deficiencies quite clearly, and have embarked on a massive effort to catch up. A few years ago, Hitachi spent only 10 percent of its R&D money on software; now it is spending more than 30 percent.[14] Toshiba has established a "software factory" employing 3,000 programmers to work on products for business and industry. NEC spends $400 million annually on software development. Still, leaving aside these efforts by hardware manufacturers, and leaving aside the government-sponsored fifth-generation project, the Japanese software industry resembles that in the United States perhaps two decades ago—small and not very visible. The independent software houses remain weak. As in many countries, skilled programmers have been in short supply. About 90 percent of Japanese applications software continues to be undertaken on a custom basis, often by firms for their own use; meanwhile, customized programs have already fallen below 40 percent of the U.S. market, and to about 60 percent in the United Kingdom.

Custom programming is inefficient (often costing 10 to 100 times more than packaged programs), and will not persist indefinitely, if only because the burgeoning software needs of the

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[13] H.J. Welke, *Data Processing in Japan* (Amsterdam: North-Holland, 1982), ch. 6; D. Brandin, et al., "JTECH Panel Report on Computer Science in Japan," Science Applications International Corp., La Jolla, CA, under contract No. TA-83-SAC-02254 from the Department of Commerce, December 1984, p. 3-1. Both Fujitsu and Hitachi continue to make IBM-compatible computers, while NEC's operating systems trace their ancestry to Honeywell products. The operating systems developed by these companies may have U.S. origins, but today in at least some cases the Japanese versions are superior. One of the objectives of Japan's heavily publicized fifth-generation computer project, discussed later, is to help Japanese companies take the next step in breaking free of their long-standing dependence on American software.

[14] In the past, according to Hisao Ishihara, Managing Director of the Japanese Software Industry Association, "Hardware manufacturers have been lazy about developing software." See "Software: The New Driving Force," *Business Week*, Feb. 27, 1985, p. 96.

Japanese economy can only be accommodated through greater adoption of standardized applications packages; the rapidly growing hardware base in Japan, now second in the world after the United States, will force change. Over the next 10 to 15 years, as they respond to these pressures, Japanese software suppliers will markedly improve their competitive positions.

Software Technology

Their overwhelming reliance on customized software contains the seeds of the Japanese industry's future development. In software, as in manufactured goods, Japanese companies have elevated process engineering to a high art. Software factories like Toshiba's reportedly produce large volumes of code with levels of quality (as measured by freedom from errors) and productivity (as measured by lines of code per man-year) substantially higher than in the United States or Europe. These software factories typically specialize in programming for particular classes of applications—e.g., process-control packages for nuclear powerplants and steel mills, aircraft flight control systems—making it easier to re-use blocks of code, as well as to train the programming staff narrowly but deeply.[15] Thirty percent or more of a given package may be recycled from past programs, helping both quality and productivity; Toshiba's Software Workbench claims an error rate of 0.3 bugs per thousand lines of code, a factor of 10 below typical U.S. error rates.

When the Japanese software industry moves, as it must, toward prepackaged applications programs rather than custom and semi-custom products, the software factory experience should prove of considerable value. But releasing a bug-free program means little if the software fails to meet user needs. For general-purpose applications packages, with design requirements that will be fuzzy and ill-defined compared with custom-tailored programs, market success depends first of all on conceptual design. Japanese software firms generally lack experience in developing and marketing programs that can satisfy mass markets. Their strengths lie in the steady improvement, often through painstaking and expensive trial-and-error, of existing products and processes. (Recall their improvements on U.S.-developed operating systems.) On the other hand, if the ideas become available—perhaps from American firms or American software designers hired by the Japanese—Japan's experience base could provide the foundation for future cost advantages in software. Indeed, this is part of the Japanese strategy: a Toshiba executive has said, "To overcome Japan's language problem and compete with the United States, we have to have productivity double that of the U.S."[16] To help surmount their handicaps in conceptual design, Japanese software suppliers will not hesitate to follow electronics firms and automobile manufacturers in establishing design centers in the United States.

At the same time, the generally poor reputation of Japanese applications programs hides real strengths. Efforts over the years to develop Japanese language input/output terminals, and, more recently, word processing software, may help Japanese firms gain the lead in some kinds of applications packages. In manufacturing, many Japanese companies have implemented simple but sophisticated factory automation systems, with software already well-proven in practical applications; Japanese software for numerically controlled machine tools, for automated inspection, and for statistical quality control may be less than innovative—perhaps even derivative of American technology—but it works, and works well. Other examples of successful applications software lie hidden inside many Japanese corporations. In the future, Japanese software suppliers will be able to build on these achievements.

On the other hand, their language will create ongoing difficulties for Japan's software suppliers, particularly when it comes to overseas sales. Japanese programmers, not surprisingly, prefer to work in their own language where possible. To export software, they must translate not only codes (commands, prompts and comments) into English or some other language acceptable in the foreign market, but also the accompanying documentation, including training materials. (At present, the U.S. firm Lotus Development supplies software packages in seven languages.) Given the long-term vendor-customer relationships and the turn-key environments typical in Japan, documentation has not been up to Western standards.

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[15] The specialties given are those of the Software WorkBench of Toshiba Fuchu—"JTECH Panel Report on Computer Science in Japan," op. cit., pp. 3-3 to 3-4. Also see *Information Technology R&D: Critical Trends and Issues* (Washington, DC: Office of Technology Assessment, February 1985), p. 85.

[16] "Software: The New Driving Force," op. cit., p. 98.

There is another side to the matter of language differences, however, one that may eventually have effects on competitiveness in *many* industries. Because written Japanese uses some 2,000 kanji characters, typewriters have been expensive and difficult to operate. Likewise, computer terminals have been beyond the capabilities of people lacking special training. Business communications in Japan depend on handwritten documents to an extent unheard of in the West for decades. Now, with Japanese language capability becoming available in computer systems, Japan's companies, no matter what industry they compete in, will be able to tap a major new source of productivity improvement. During 1985, production of Japanese-language word processors increased from about 30,000 per month to nearly 250,000 per month, while average prices dropped by a factor of 5.[17]

Moreover, Japanese word processing software is in some respects already quite advanced; the system must interpret keystrokes representing phonetic combinations, "guessing" the operator's meaning based on context and expressing that meaning in kanji. Programs that do this become, in effect, applications of AI. The Japanese companies that have developed this software should be able to transfer some of the techniques to other types of programs, with subsequent competitive advantages.

The Fifth-Generation Project

When it comes to technologies like AI, it is the fifth-generation project that gets most of the attention outside Japan. Begun in 1982 under the auspices of the Institute for New Generation Computer Technology (ICOT), the goal of the fifth-generation project is to extend applications of massive computing power to ordinary users by harnessing AI, natural language input capability, and very large databases. The intent is to leapfrog existing—i.e., American—computer technologies. This is not the first time that joint government-industry R&D, a process refined in Japan over several decades, has been turned to the "software gap."[18]

The fifth-generation project's budget, averaging less than $50 million per year, is not large compared to internal corporate R&D spending, or, for example, to the Strategic Computing program of the U.S. Department of Defense. This by no means makes the project unimportant. The technical goals will be very difficult to achieve. But as many other joint projects in Japan have demonstrated, focusing exclusively on technical objectives misses the point. Such projects serve many other functions in Japan's industrial policy system, ranging from consciousness-raising and consensus-building to training technicians and engineers. In Japan, where concerted efforts to build an "information economy" go back to the 1960s, the government looks to computers (and communications) as the centerpiece of the nation's future economic structure, a structure emphasizing knowledge-intensive, hence software-intensive, goods and services. The fifth-generation project is one part of this larger effort.

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[17] "Output Outlook by Sector," *Japan Report—Science and Technology*, Joint Publications Research Service JPRS-JST-86-070-L, Oct. 30, 1986, p. 47. Translated from *Nikkei Electronics*, Apr. 7, 1986.

[18] On Japan's approach to joint government-industry R&D, including the objectives of the fifth-generation project, see *International Competitiveness in Electronics* (Washington, DC: Office of Technology Assessment, November 1983), pp. 416-419.

One of the more important of the early software-intensive efforts, the Pattern Information Processing System (PIPS) project, helped Japanese companies develop technologies for input devices that could accept kanji characters. The recent SIGMA project (Software Industrialized Generator and Maintenance Aids), initiated in 1985 by the Information Technology Promotion Agency, seeks increased productivity in programming though software engineering techniques and automation. This effort, scheduled to run through 1989, has a planned budget of more than $150 million and involves nearly 130 companies. See A. Cane, "Japan's $100m Software Boost," *Financial Times*, Sept. 18, 1985, p. 14; also S.K. Yoder, "Automating Software," *Wall Street Journal*, Nov. 10, 1986, p. 33D.

Trade Barriers

As in other industries, direct and indirect barriers have made it difficult for U.S.-based firms to sell software in Japan. For example, many American companies contend that Nippon Telegraph & Telephone (NTT), potentially a huge customer for U.S software, gives preferential treatment to Japanese companies. After lengthy negotiations and much pressure from the U.S. Government, NTT—now partially privatized—has begun to show signs of opening up its procurement process, with software one of the areas of progress. Time will tell whether this concession represents the first step in what would inevitably be slow progress toward more open procurement, or whether it represents no more than a token concession by the Japanese.

U.S.-Japan friction over copyright protection for software has been as heated as that over NTT's procurement practices. A 1983 bill prepared by MITI and introduced in Japan's legislature, the Diet, called for compulsory licensing of software where the Japanese Government deemed this in the national interest. The intent was clear: MITI wished to aid Japanese firms by making it easier for them to use existing programs, particularly the IBM software that Japan's plug-compatible hardware manufacturers continue to depend on. Lengthy negotiations between the U.S. and Japanese Governments followed; other countries also protested the Diet bill, which was eventually shelved. Finally, Japan's Government promised to implement copyright provisions for software more acceptable to foreign interests.[19] If the Japanese continue to keep out American software firms, and otherwise aid their domestic industry (by, for example, allowing reverse-engineering of U.S. programs), a strong group of competitors could eventually emerge in this industry—from behind barriers much like those that earlier helped the Japanese develop their computer, semiconductor, and telecommunications hardware suppliers.

Europe

While American hardware and software firms have had a much easier time in Western Europe than in Japan, none of the European nations, individually, can compare with Japan as a potential customer (or potential competitor). As a whole, the Western European computer market exceeds that of Japan by perhaps one-third, despite a population roughly twice as great.

Although custom software does not take as high a fraction of sales in Europe as in Japan, customization remains more common than in the United States; European sales of custom software and software consulting services came to $4.5 billion in 1985, compared with $5.2 billion for packaged software.[20] By the end of the decade, standard programs are expected to outsell custom software by a substantial margin. As figure 34 indicates, West Germany should continue to be the largest market for packaged software, followed by the United Kingdom and France.

If third as a market, France nonetheless has the strongest software industry in Europe. The biggest independent European software supplier, the French firm CAP Gemini Sogeti, specializes in mainframe programs, doing nearly 60 percent of its business outside France; still, the company's 1985 revenues of about $250 million only slightly exceeded those of the American PC specialist Lotus Development. As in other countries, French computer hardware and telecommunications equipment manufacturers—notably Alcatel, Thomson, and Bull—have been major players in software.

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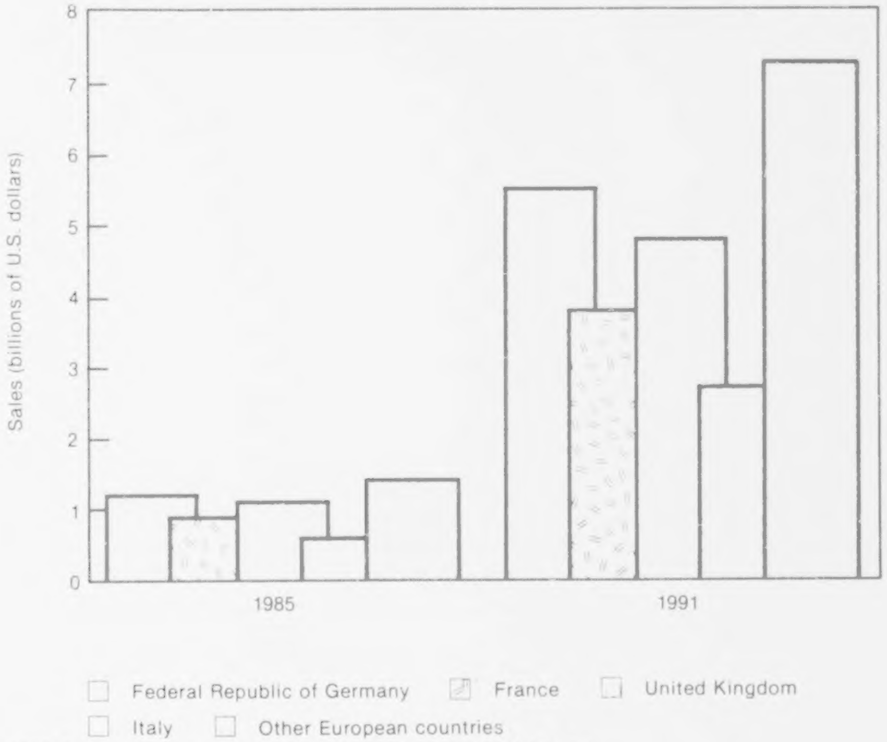
[19] S. Chira, "Japan Plans To Provide Protection for Software," *New York Times*, Mar. 19, 1985, p. D13. While the new plan was proposed in 1985, no action had been taken as of mid-1987.

[20] "European Software and Services Market," *Financial Times*, Sept. 22, 1986, p. III.

For the 1985 revenues of Cap Gemini Sogeti, below, and other European firms, see "French Software Firms Strong in Europe," *Europe Report—Science and Technology*, Joint Publications Research Service JPRS-EST-86-038, Dec. 8, 1986, p. 22. Translated from *Zero Un Informatique*, Aug. 18, 1986.

Figure 34.—Projected Sales of Packaged Software in Western Europe



SOURCE: "Software Packages for Business," *Financial Times*, June 27, 1986, p. I

In Germany, the local industry centers on the hardware manufacturers Siemens and Nixdorf, the latter specializing in turn-key systems, especially for financial institutions. A strong commitment to customer service has helped Nixdorf win a small but growing share of the market; the firm has even penetrated French banks, a difficult feat.

With so much of Europe's hardware base supplied by American-owned companies, much of the software, particularly systems programs, also comes from American firms. U.S.-based computer manufacturers like IBM, DEC, and Hewlett-Packard have substantial presences in Europe. IBM operates half a dozen European R&D centers, each of which undertakes software or related work; in 1983, IBM alone took more than one-quarter of all Western European sales of off-the-shelf systems software.[21] Many independent U.S. software and services firms —Cullinet, MSA, Comshare, ADP—have also invested in Europe. In some cases, their affiliates function as sales offices only. In others, they carry out R&D and/or production. ADP's Dutch subsidiary, for example, has developed software for auto parts wholesalers and retailers that is now marketed through ADP offices elsewhere in Europe.

Over the next few years, the fastest growing portion of the European software market, as in the United States and Japan, will consist of business application programs for PCs. About as many people work in Western European offices as in the United States—60 million. Yet businesses in Europe lag well behind in their purchases of PCs, with fewer than 5 million in use, compared with about 8 million in American offices.[22] Moreover, the home market for PCs in Europe has barely been tapped. As a result, both PC hardware and software sales may grow faster in Europe than in the United States over the next several years—creating attractive market opportunities for American firms.

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[21] R. v. Gizycki and I. Schubert, *Microelectronics: A Challenge for Europe's Industrial Survival* (Munich: R. Oldenbourg, 1984), p. 93; *Financial Times*, May 1, 1985, p. III. U.S.-owned firms account for five of the top six independent suppliers of packaged systems programs, although European-owned firms do better when it comes to custom software.

From their beginnings, the newest generation of U.S.-based software startups, most of whom specialize in programs for PCs, have sought and found markets in Europe. U.S.-based software suppliers invest overseas for two fundamental reasons: to be close to their markets, and to save on development costs. Software for applications like accounting must be tailored to each national market—not only in terms of language, but, in this example, in terms of accounting conventions and standards. American companies often set up local offices or subsidiaries to handle the necessary program modifications. Moreover, software development costs less in Europe, largely because salaries for programmers average about half those in the United States. The U.S. firm Comshare, for instance, does about 40 percent of its development work overseas, mostly in Ireland, where the firm's investments save the company about $4 million per year. While countries like India, Hong Kong, and Hungary also offer lower programming costs, thus far the British Isles have proved most attractive for American firms (including IBM, DEC, Hewlett-Packard, and Prime).

European software firms themselves, with only a few exceptions, remain minor players internationally. Like Japan, the European nations (and the European Community) have begun funding R&D intended to strengthen their capabilities in software; chapter 9 describes both the Community-wide ESPRIT effort and Britain's Alvey Program.

Of the developing nations that have sought to build software industries, India has been perhaps the most aggressive, with software exports growing at 40 percent annually.[23] The country has the advantage (for this purpose) of many chronically unemployed or underemployed university graduates; American firms including Texas Instruments and Citicorp have established software development facilities in India, while other American companies have contracted out programming to local firms. Countries including Singapore and Taiwan have also attempted to establish themselves as centers for software development, but typically face acute shortages of well-trained people.

Competitive Dynamics

Today, software industries in the United States and overseas are in a state of flux; the biggest supplier of PC software, Lotus Development, was founded only in 1983. High-end software specialists have been seeking to expand into other segments of the market, attracted by the many new customers for small computers, while also moving to exploit the advantages of fourth-generation languages. In this environment—highly competitive and technologically volatile—many companies have sought to expand their product lines through mergers and acquisitions (more than 200 in 1985, over 300 in 1986) as well as internal product development. Acquisitions can broaden a firm's customer base; they can also help expand its programming staff—a critical need for rapid growth.

U.S. advantages in the evolving world industry begin with the large domestic market, driven by a hardware base that is still growing rapidly. With the interdependencies of hardware and software design increasing, this should prove a continuing source of strength for the U.S. industry, while also serving as a prod to Japan's efforts.

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[22] The business penetration figures come from presentations at the 4th Professional Personal Computer Conference, London, Oct. 30-31, 1986, by M. Swavely, Compaq Computer Corp. (for the United States) and B. Morel, Intelligent Electronics Europe.

[23] The base for this growth has been small, only $24 million in 1984. "Showing the Way For Developing Countries," *Financial Times Survey*, Oct. 4, 1985, p. iii; "India's Climate Looks Good to U.S. Software Makers," *Business Week*, Oct. 13, 1986, p. 138-H.

On Singapore and Taiwan, see *International Competitiveness in Electronics*, op. cit., pp. 383-389; also "Asia's Hi-Tech Copy Cat Aims for Lion's Role," *Financial Times*, May 17, 1985, p. 3.

At present, France probably has the most competitive software industry outside the United States: about half of the 20 largest software suppliers to the European market are French, compared with two British companies, and one from West Germany. But in the longer run, Japanese firms will emerge as the principal competitors for American suppliers, if only because of the growth and increasing competitiveness of the hardware sector in Japan. U.S. software firms could also face somewhat stronger competition if European efforts to foster innovation and entrepreneurialism in software bear fruit.

Japan's Government has begun focusing resources and attention on productivity in the generation of software, an effort that could have substantial long-term implications, as could government-sponsored projects in a number of countries to speed developments in artificial intelligence. Nevertheless, the traditional sources of U.S. strength in software—skilled personnel, strong R&D programs with substantial Federal funding, particularly for burgeoning military applications, and capital markets that are deep and flexible—will persist. U.S. Government policies that ensure access to foreign markets—including effective intellectual property protection for software (see ch. 9)—would help maintain existing U.S. advantages in this industry, one that is critical for future U.S. economic growth and competitiveness.

TELECOMMUNICATIONS SERVICES

Although telecommunications is much the largest of the IT services in terms of revenues and employment, most of the activity is confined to domestic markets. In 1984, revenues for marketed telecommunications services, voice and data, totaled some $109 billion in the United States, nearly $70 billion in Western Europe, and $22 billion in Japan.[24] By definition, there can be no trade in domestic telephone traffic, by far the largest income earner of all telecommunications services, nor for domestic leased lines and data communications, the second largest revenue item for most PTTs.

Governments have closely regulated telecommunications, viewing the sector as a natural monopoly and the service a public good. For such reasons, publicly owned PTTs or publicly regulated private monopolies have been common; most of the world retains the former, while in the United States AT&T's regulated monopoly has broken down only in the last few years. Trade, then, consists largely of cross-border voice, message, and data communications—also regulated (box M). Beyond this, value-added services, mostly supplied through VANs, and including videotex, hold attractive market opportunities. Future competition promises to be heated, both within national markets, where creeping deregulation has in some cases meant that American firms have been permitted to enter VAN markets, and for cross-border VAN services. Intense competition for sales of telecommunications equipment complicates the picture.

The Competitive Environment

Basic telephone service continues to generate most telecommunications revenues.[25] However, conventional telephone circuits are ill-suited to the rapidly expanding volume of data

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[24] "Telecommunications Survey," *The Economist*, Nov. 23, 1985, p. 8.

On satellite communications, including the emergence of fiber optics as a potential rival for international circuits, see *International Cooperation and Competition in Civilian Space Activities* (Washington, DC: Office of Technology Assessment, July 1985), ch. 6.

[25] Revenues for other than basic telecommunications came to $8.9 billion in the United States during 1985, including revenues from leased lines—less than 10 percent of total domestic telecommunications revenues. VANs accounted for only $300 million. See P.R. Strauss, "1986 Market Survey: Most Sectors Strong Despite Slowdown Fears," *Data Communications*, January 1986, p. 73.

Box M.—International Telecommunications

The market for cross-border telecommunications services is one of regulated competition, with, for instance, satellites and undersea cables tightly controlled. Joint ownership by U.S. carriers and foreign PTTs has been the rule for ocean cables terminating in this country. With the advent of satellite links, Comsat (Communications Satellite Corp.) became the privately owned U.S. monopoly carrier and signatory to the Intelsat system (the International Telecommunications Satellite Organization, created by international treaty in 1964). The United States, as the moving force behind Intelsat, provided 90 percent of its capital in the early years; Comsat still owns 23 percent of the international consortium. Regulations and rates on international leased lines vary depending on the countries at the two ends of the line; the Consultative Committee for International Telephone and Telegraph (CCITT) of the International Telecommunication Union (ITU) provides a framework for bilateral agreements. Currently, a private Intelsat line between the United States and Britain can cost from roughly $50,000 per year to something over $500,000, depending on bandwidth (a measure of capacity).

Intelsat continues to control nearly all cross-border satellite communications, including television.[1] Although at least nine firms now offer telephone service within the United States using satellite links, Comsat continues to provide the only access to Intelsat circuits. But deregulation promises change. Following a 1984 decision by President Reagan to permit new entrants in competition with Intelsat, the Federal Communications Commission (FCC) approved conditional licenses for five American companies seeking to provide international satellite services. While the customers of these new entrants would be permitted to resell or lease lines to third parties, the FCC has prohibited interconnection with public switched networks, thereby protecting the core of Intelsat's business. (Congress had directed the Administration to avoid economic harm to Intelsat.) Meanwhile, fiber-optic cables have emerged as cost-effective competitors for satellite circuits in many parts of the world. Intelsat has responded to the threat of competition by cutting prices and expanding services.

Further opening of international competition in basic services would require cooperation from PTTs controlling interconnection at the other ends of cross-border links. This is not likely. In 1976, the FCC proposed to expand competition by authorizing resale on international private leased lines—used by many multinational corporations (MNCs) for communications between branches in different countries—as it had done for domestic private lines. The FCC proposal represented a direct threat to PTTs in Europe (where most U.S. foreign investment is concentrated), and was met by the threat of a shift from flat-rate tariffs to time- or volume-related tariffs (or even disconnection). This would have raised costs for U.S.-based MNCs, while maintaining revenue levels for the PTTs. The FCC was forced to retract its proposal.

Two years later, the FCC again gave notice of its intent to authorize resale of international leased lines. Other countries considered this a breach of ITU rules because a CCITT recommendation had stipulated that no resale or shared use of international leased lines be permitted. While CCITT recommendations do not have the force of treaty obligations, it again became clear that action by the United States would provoke retaliation. Once more, the FCC backed down.

Such disputes will not disappear, if only because the private satellite carriers authorized by the United States will continue chipping away at Intelsat's monopoly. The issues are essentially the same as in domestic liberalization, with an overlay of foreign policy questions. Is there a need for specialized services that Intelsat does not now provide? If either Intelsat or private carriers provide such services—i.e., to MNCs—would costs for other Intelsat customers go up? Deregulation in the United States has meant a move toward cost-based pricing, a choice rationalized on grounds of efficiency. Corporate customers and some household customers benefited from lower rates and a bigger menu of services; others had to pay more. Much the same policy choice presents itself internationally, promising to generate controversy for years to come because decisions will be linked to questions ranging from North-South relations to sales of satellites and ground equipment.

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[1] *International Cooperation and Competition in Civilian Space Activities* (Washington, DC: Office of Technology Assessment, July 1985), pp. 180-188.

communications. With digital central office switches—themselves large computers—replacing electro-mechanical crossbar switches, and digital circuits replacing analog, the infrastructure is rapidly becoming a network of computers rather than one of telephones (and telegraphs and telexes). It is this blurring of boundaries between computing and communications that undermined much of the old regulatory structure in the United States, setting the stage for deregulation.

New communications technologies in a deregulated environment permit corporate users to bypass portions of the public telecommunications network. With local service bypass, lines—normally leased from the local service provider--go directly to the long distance access point in a local switching area. Companies with a higher traffic volume may find it cost-effective to invest in local facility bypass, with a link (normally microwave) going straight to the long distance carrier, bypassing local switching facilities completely. With system bypass, the corporation operates its own dedicated network, using private satellite, fiber-optic, or cable links to join its facilities. Total system bypass makes sense only for large organizations.

The AT&T breakup has had major repercussions internationally. With its manufacturing arm, Western Electric, freed from earlier restrictions on sales of telecommunications equipment abroad, AT&T has begun seeking alliances with foreign firms and access to foreign markets. At the same time, Western Electric can no longer count on the business of the regional holding companies (RHCs) and Bell operating companies (BOCs). Divestiture also meant AT&T could enter computer markets for the first time.

The opening of U.S. markets for services and the new competition for equipment sales created pressures for change elsewhere. Foreign firms, particularly larger businesses, saw that following the U.S. lead could result in lower costs and better service. Many grew concerned that their national PTTs might hold back introduction of new technology, putting them at a competitive disadvantage.

Specifically suitable for
- ELECTRONIC MAILBOX SYSTEMS
- ORDER ENTRY
- INVENTORY CONTROL
- VIDEOBANKING
- ELECTRONIC DIRECTORIES

Photo credit: DGT/Intelmatique

Terminal for France's Teletel/Minitel videotex system.

As in financial services, then, deregulation has begun to spread to other industrialized countries. But, as noted in box N, the pace will be much slower in telecommunications. Government-controlled PTTs—run by civil servants and in some cases operating under laws little-changed since the 19th century—have no wish to relinquish their hold on basic services. Not only do many PTTs cross-subsidize their labor-intensive mail delivery services with telecommunications revenues, but a great deal of pressure for maintaining public monopolies or private regulated monopolies in telecommunications services stems from the desire of governments to protect and strengthen national champions in the manufacture of equipment.

As indicated in box N, procurement policies, formal and informal, have been used to buttress computer and telecommunications suppliers in countries ranging from West Germany (Siemens), to Japan (NEC, Hitachi, Fujitsu, Oki), to Brazil (many manufacturers that remain small by international standards). Import penetration levels for telecommunications equipment range from less than 1 percent in Japan, and under 3 percent in France and West Ger-

Box N.—Regulation and Deregulation in Foreign Telecommunications Markets

Events over the past decade in the **Federal Republic of Germany** (FRG) illustrate the potentially high costs to businesses of government policies that shelter all aspects of telecommunications. West Germany's state-owned monopoly, the Bundespost, maintains unchallenged authority over mail, telephone, telegraph, all forms of data communications, and radio/TV broadcasting: at one point the agency went so far as to ban Mickey Mouse telephones.[1] Now the last remaining major industrial country with a total telecommunications monopoly, pressures for change have mounted rapidly in the FRG, not only from business leaders critical of the Bundespost for putting roadblocks in the way of new telecommunications technologies, but from other parts of the government. Meanwhile, the Bundespost and its political allies have fiercely resisted change.

Perhaps the first sign of real loosening in the German regulatory approach came in 1986, when the Bundespost began permitting manufacturers of modems (used for transmitting digital data over the telephone system) to market them directly.[2] Nonetheless, a company wishing simply to link computers in two adjoining buildings must still go through the Bundespost; users must get approvals for each modem, along with private switching systems, LANs, and other hardware installations. Laws governing transborder data flows (TBDFs) also require that some data processing take place in Germany, restricting access to on-line databases maintained outside the FRG, as well as limiting some kinds of VAN services.

The Germans, therefore, despite their generally favorable stance toward liberal trade, have been put in the position of defending a tightly regulated telecommunications monopoly, an irony that does not escape them. An expert committee including representatives of business, political, and technical interests has been established by the government to examine the question of reorganizing the Bundespost. Further slow deregulation will probably follow in the wake of the modem decision; as a next step, private firms may perhaps be allowed to resell leased lines and establish some types of VANs. Several American-owned firms, including IBM, are moving to establish limited-service VANs, but the Bundespost will probably succeed in keeping private firms, regardless of ownership, from supplying services that it expects to offer, such as electronic messages.

Although slow to deregulate, the FRG has been in the lead in seeking European agreement on ISDN, with the Bundespost announcing ambitious plans. Other countries have tended to see German efforts to move quickly toward European standards for ISDN as an attempt to create advantages for the FRG's equipment manufacturers —notably Siemens, traditionally favored by the government. Siemens, which supplies nearly half the equipment purchased by the Bundespost, has made heavy commitments to ISDN hardware design, developing an entire line of products from components to mainframe computers and CO switches to take advantage of its position and experience. As this and other examples suggest, a good deal of trade-related friction concerned with telecommunications over the next few years will mix questions of equipment and services.

In **France**, the Direction Generale des Telecommunications (DGT) maintains a regulated monopoly in basic services, but limited competition has been permitted in value-added services. Private firms can seek approval to offer services through the DGT's Teletel/Minitel videotex system, which makes use of the public telephone network.

Teletel/Minitel has quickly become the most successful videotex system in the world, thanks to subsidies providing free terminals for home use. The government has also made it easy for private firms to enter the information services business through a vehicle called *Kiosque*. Approvals are simple, and the DGT even offers programming assistance. Of the nearly 2,000 services available, perhaps two-thirds cater primarily to business and professional customers, with the rest directed at households; banking and financial services have been especially popular.[3]

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[1] P. Cogez, "Telecommunications in West Germany," Berkeley Roundtable on the International Economy, University of California, Berkeley, 1985. Also G. de Jonquieres, "Crossed Lines in an $80bn Industry," *Financial Times*, July 5, 1985, p. 14; R. Thurow and P. Gumbel, "Big German Monopoly Ties Up the Telephone and Its Competitors," *Wall Street Journal*, Oct. 24, 1985, p. 1.

For background on regulation/deregulation, primarily in the United States, see G.W. Brock, *The Telecommunications Industry: The Dynamics of Market Structure* (Cambridge, MA: Harvard University Press, 1981).

[2] "Bundespost Reaches Deregulation Milestone," *Financial Times*, July 31, 1986, p. 6. Previously, the Bundespost, as sole source of supply, sold rather primitive modems at double or triple the prices common in other countries, while also prohibiting computer equipment with built-in modems.

Indeed, the demand for *Kiosque* services—now about 50 million calls per month—quickly overloaded the TRANSPAC network (a DGT subsidiary), the primary vehicle for Teletel/Minitel services. Users of the French telecommunications system had been urging faster deregulation, and the DGT's failure to anticipate TRANSPAC's capacity problems added to the pressures. These must be counted as the failures of success. Since most of the *Kiosque* services bring in revenues to the DGT (roughly 30 percent of user fees go for billing services and network access), the agency has more than recouped the cost of the terminals it has supplied. Not only has the Teletel/Minitel system stimulated expansion of private IT services in France, but the public has been largely won over, which will reduce barriers to the further spread of information technology in French society.

The French Government approved an ambitious ISDN program in 1982, providing, even in the early stages, for bi-directional videotex service, and has promised liberalization of VANs. Thus far, however, foreign participation in proposed new services has been limited to joint ventures with French companies.

In **Japan**, shares in the domestic carrier, NTT, formerly a public corporation, are being sold to private investors. Under legislation that took effect in 1985, the government will retain 51 percent of NTT's stock; foreigners can only buy shares through joint ventures having majority Japanese ownership. The government will permit other companies to compete with NTT in the market for Class 1 or basic telecommunications services (with foreign interests restricted to minority joint venture positions). With some half-dozen new Class 1 rivals, NTT may eventually face substantial competition; like the RHCs and BOCs in the United States, it will have to adjust its rates and reduce cross-subsidization to match the prices of its competitors. However, unlike AT&T in the U.S. market, NTT did not have to subdivide into regional or local operating companies. This should make it easier for NTT to pursue its goal of establishing a nationwide ISDN network.

Japan's Business Communication Law establishes a second category of Class 2 or enhanced services; these include VANs, whether or not they make use of Class 1 network services. The law provides for two types of VANs, General and Special. Private corporate networks account for most of the General VANs, which have been left largely unregulated. Special VANs, including all inter-firm networks, remain under relatively tight controls. Because of this, only nine applications had been made for Special VANs as of the end of 1985, while more than 175 companies had registered General VANs with the Ministry of Posts and Telecommunications.[4] In a typical application, Nomura Computer Systems supplies ordering and point-of-sale terminal services to more than 2,500 7-Eleven stores in Japan.

As in Germany, telecommunications equipment sales in Japan were, for many years, the province of a small group of firms—the so-called DenDen family, consisting of NEC, Hitachi, Fujitsu, and Oki. NTT, which did not manufacture equipment, nonetheless spent large sums on R&D, transferring the results to its favored suppliers. An intense trade dispute with the United States over the purchase of switching systems and other equipment led to the resignation of NTT's president in 1981. The new president was reportedly given a mandate to increase foreign purchases, but progress has been slow: NTT purchased 14 million dollars' worth of U.S. equipment in 1982, $45 million in 1983, and $130 million in 1984 and 1985. With business users beginning to express dissatisfaction with NTT's services, frustration over efforts to change NTT practices from within—coupled with a widely perceived need to respond in some way to the challenge posed by deregulation in the United States—set the stage for the market-opening steps that came in 1985. Liberalization will probably help Japanese firms compete in international markets for services, as well as equipment.

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[3] B. Tilge, presentation at CIT-Alcatel sales meeting, Charlottesville, VA, July 15-18, 1985. Also see "Output Outlook by Sector," *Japan Report—Science and Technology*, Joint Publications Research Service JPRS-JST-86-070-L, Oct. 30, 1986, p. 50; P. Betts, "Controls Eased on Telecommunications Services in France," *Financial Times*, May 21, 1986, p. 2; J.A. Hart, "The Teletel/Minitel System in France," *Network World*, forthcoming.

[4] "Output Outlook by Sector," op. cit., p. 50. The number of VAN applications has since passed 250—"Status of Liberalization of International VAN Reported," *Japan Report—Science and Technology*, Joint Publications Research Service JPRS-JST-86-082-L, Dec. 17, 1986, p. 111. Translated from *Nikkan Kogyo Shimbun*, Sept. 1, 1986.

For the 7-Eleven example, below, see T. Murtha, "Tokyo Takes Off—Slowly," *Datamation*, May 1, 1986, p. 60.

The **United Kingdom** has also begun to deregulate, with the Thatcher Government separating British Telecom (BT) from the British Post Office in 1981, and, 3 years later, selling 50.2 percent of BT's stock to the public.[5] The government also licensed a private telecommunications firm, Mercury, to compete with BT. Moreover, with the value-added network services licensing act of 1982, and later clarifications, Britain has greatly liberalized its markets for value-added services. Although licensing procedures for VANs remain in a state of flux, some 200 plus had been registered by the end of 1986, more than in the rest of Europe combined. These provide services that include teleconferencing, ticketing and seat reservations for British Rail, theater and concert tickets, access to databases, accounting and statistical packages, telephone information services, credit authorization, real estate information, insurance quotations, and news. Moreover, the rapid pace of deregulation in Britain, compared with the rest of Europe, has attracted many MNCs seeking to centralize their European data processing and telecommunications operations; EDS, for example, is investing heavily in the United Kingdom, and expects to employ 4,000 people there by the end of 1987.

In some contrast, Britain's videotex system, Prestel, has had little success, in part because Prestel was based on household TVs equipped with expensive decoders. Many services geared to home consumers failed to prosper, although a few—home banking, news headlines, stock quotation services—have survived.

Mercury, BT's new competitor, plans to limit its service to larger urban markets, linking them via fiber-optic cables laid along the nation's railway tracks. Mercury will be able to target business customers, taking advantage of the digital broadband capabilities of its network. BT, much like AT&T in the United States, has a large existing infrastructure—much of it based on obsolescent technology—but gets advantages from the geographic breadth of its coverage. Nor is it clear that Mercury will prove a viable rival. Unlike the Japanese, the British have placed no restrictions on foreign ownership of either telecommunications carrier, but given Mercury's relatively modest plans, and a commitment by the government to restrict the field to these two firms until 1990, liberalization in the United Kingdom has something of a cosmetic appearance. Still, BT has already cut its prices to match those offered by Mercury.

Brazil's telecommunications and informatics policies, which quite openly shield Brazilian computer, software, and telecommunications equipment firms, have led to considerable friction with the U.S. Government.[6] Other developing countries have looked to Brazil's policies as a possible model, while the Brazilians themselves have sought to adapt some features of the Japanese model. Even so, two other relatively industrialized developing countries, Mexico and India, have recently opened their markets somewhat, after earlier pursuing policies more like Brazil's.

As in France, Germany, and Japan, TELEBRAS, the Brazilian PTT, follows a policy of preferential procurement: only if Brazilian firms cannot supply the needed equipment does TELEBRAS turn to foreign sources. Brazil currently imports perhaps 10 percent of its telecommunications equipment. When it comes to computers, Brazilian informatics policy likewise has been intended to strengthen the country's technological capabilities and reduce its dependence on imports. Thus the policy includes direct import barriers as well as preferential procurements—actions that have been widely supported by Brazilian hardware manufacturers and nationalist political groups. In 1984, the legislature passed a measure barring foreign firms from producing or selling most micro- or minicomputers. Imports have dropped precipitously, from about 70 percent of the market to 20 percent.

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[5] F. Bar, "Telecommunications in the United Kingdom," Berkeley Roundtable on the International Economy, University of California, Berkeley, 1985; G. de Jonquieres, "The Muddle That Is Slowing VANs," *Financial Times*, Sept. 10, 1985, p. 19; G. Shaw, Opening Address at World Telecommunications, 1986, London, Dec. 1-2, 1986.

[6] See *Transborder Data Flows and Brazil* (New York: United Nations Centre on Transnational Corporations, 1983). While the title suggests a narrow focus, in fact this study deals with Brazilian telecommunications policy as a whole. Also A. Riding, "Brazil's Prickly Computer Policy," *New York Times*, Apr. 29, 1984, p. D4; A. Riding, "Brazil's Protected Computers," *New York Times*, Sept. 16, 1985, p. 32; "Only Three Countries' Computer Industries Can Meet Even Part of Needs, Report Says," *International Trade Reporter*, May 21, 1986, p. 699. Primarily on computers, see C. Frischtak, "Brazil," *National Policies for Developing High Technology Industries*, F.W. Rushing and C.G. Brown, eds. (Boulder, CO: Westview, 1986), p. 31.

Foreign telecommunications firms can offer services so long as these do not challenge the PTT's monopoly. Gateway services like GTE/Telenet operate in Brazil; so do closed user networks like SWIFT and SITA (the international airline reservation system described in box R below). But all leased lines and cross-border VANs must be authorized, there is virtually no intellectual property protection for computer software, and the government restricts access to foreign databases unless a national security need can be demonstrated.

Some users of IT services in Brazil, as well as subsidiaries of foreign firms, continue to press for changes in these policies, but to little effect. Domestic computer manufacturers matched the sales of foreign firms for the first time in 1984. The military supports the telecommunications and informatics policies, along with nationalists on both right and left politically. Brazil's Government has responded to U.S. objections to its discriminatory policies by pointing to the country's need to reduce imports and keep the economy growing in order to pay off foreign loans. The policies have not been cost-free. Prices of telecommunications services and computers in Brazil are high, quality of products and services poor. But the political costs have been small, and the policies will likely be continued.

many, to 9 percent in Britain, and 14 percent in the United States.[26] Nonetheless, European equipment markets have begun to open up somewhat—in part because high R&D costs for new generations of CO switches are forcing firms into joint endeavors. Deregulation of value-added services has also begun in some countries, but VANs remain government monopolies in at least five European nations, and PTTs view them as threats to revenues from telex services (the electronic mail of an older technological generation).

The Telecommunications Infrastructure

Basic telecommunications—transmission of voice, messages, and digital data—provides the infrastructure for new services as well as those that have been familiar for years. Most of these new, or enhanced, services provide additional data communication functions. Examples include protocol conversions, so that different computers can talk to one another, message storage and electronic mail, and on-line access to large databases. Over the next several decades, current generations of digital equipment—Phase II in table 20—will be supplanted by ISDN systems, able to handle higher volumes of data communications traffic, and, as the name implies, eventually integrating the broadband capability needed for video into the network.

Phase I in table 20 describes the infrastructure in most industrialized countries as of the early 1970s—a system almost entirely analog (also see box O). During the 1970s, software-programmable CO switches—in essence large computers—began to replace electro-mechanical crossbar technology. At this point, network functions began to move beyond simple transmission of messages, while—with declining costs for microelectronic devices—voice transmissions could be sent over digital lines as easily as data originating in digital form. Today, most local U.S. telephone service continues to utilize analog circuits, while digital long-distance transmission has become common. Phase II also brought greater use of satellite links, and the first installations of fiber-optic cables, which transmit via light rather than electrical signals. Satellite and fiber-optic transmission make possible broadband links, capable of carrying video signals along with voice and data. Packet-switching—which breaks messages down into short bursts, or packets, that can travel by varying routes, to be recombined at their destination—helps carriers utilize networks to their full capacity.

With broadband capability, system designers can contemplate an integrated network, one capable of handling voice, data, facsimile, and video signals. The spread of such ISDN systems

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[26] "U.S. and Europe Dominate $150bn World Market," *Financial Times*, Oct. 21, 1985, p. 4.

Table 20.—Three Phases of Telecommunications Technology

Phase	Time period	Circuitry	Switching system	Physical infrastructure	Services
I	Into the 1970s	Analog	Electro-mechanical crossbar	Mostly copper cable[a]	Telephone, telegraph, telex
II	Present	Analog/ digital mix	Circuit and packet switching	Above, plus microwave, satellite, fiber-optics	Above, plus high-speed data communications and facsimile
III (ISDN)	1990s	Digital	Virtual routing and messaging	Above	Above, plus video and broadband data

[a] Microwave and satellite links began coming into service during the 1960s

SOURCE: Office of Technology Assessment, 1987

will mark the transition to Phase III during the 1990s—a transition that will probably be driven largely by demand for cheaper data communications (rather than, say, video). The range of services will continue to expand, as pointed out in box O, but the transition from Phase II to Phase III will be very expensive—in the hundreds of billions of dollars worldwide over the next several decades—the more so if different parts of the world (or different regions in the United States) adopt incompatible standards.

Value-Added Services

Both intra- and inter-firm communications will become easier and cheaper as the telecommunications infrastructure shifts toward a fully digital system. With ISDN, a customer will be able to plug any terminal device—telephone or PBX (private branch exchange), computer or terminal—into the network and communicate with any other terminal device. VANs of all types will expand, both dedicated networks—as used in banking or for airline reservations—and those such as Tymnet and Telenet that simply provide network services to many of their customers. It will also become easier for corporations to establish private networks. Today, only large companies like IBM and General Motors (whose EDS subsidiary is developing a corporate VAN, box P) can afford these investments. Indeed, as box P suggests, much of the pioneering technical development for ISDN-based VANs will probably be done by private companies, some of which will no doubt seek to use the knowledge gained through internal projects to market services to other firms.

VAN Markets

Today, most VANs in the United States use some combination of private lines (often leased) and the public infrastructure. In other nations, where PTTs may require that all VAN communications use the basic telecommunications network, costs may limit expansion. Even so, the VAN market worldwide provides many opportunities for American firms, as does that for information services (discussed in the next section).

Fundamentally, public VANs (as opposed to private networks for intra-firm communications) offer two types of services: 1) system management for data networks; and 2) system applications, such as electronic funds transfers, videotex, or database access. The first category of firms—systems managers—offer national or international telecommunications on a single-source basis; companies like Telenet (box Q) sell ease of access. It is the VAN provider that deals with PTTs in various countries, centralizes billing, and assembles and maintains the network management software. By leasing lines on a flat rate basis from a common carrier (normally the PTT), and reselling the capacity on a volume-sensitive basis, these VANs offer a package of services at a lower price than customers could provide on their own. Some also design dedicated private network for particular customers; Telenet, for instance, has put together more than 60 such packet-switched networks. Finally, VAN suppliers can create hybrid networks, interconnecting a customer's dedicated network with their public VAN to save on costs for connection to remote sites.

Box O.—Integrated Services Digital Networks (ISDN)

As table 20 indicates, the current Phase II telecommunications infrastructure mixes analog and digital telephone service, along with digital data transmission, and a telex/telegraph system (plus local cable TV). Fully digital systems, which require low-cost means for transforming voice communications from their naturally occurring analog form to a string of digital "bits" (and back) only became practical during the 1970s. While the costs of replacing the Phase I system mean that some parts of the network will remain analog for many years, all-digital systems should lead to continuing reductions in data communications costs, with particular advantages for business customers. At the same time, the telephone system will become still more highly automated, while the range of services available to households will continue to expand.

In the United States, at least one of the Bell operating companies in each of the seven RHCs is beginning ISDN field trials.[1] Japan's ambitious plans for ISDN, termed INS, or Information Network System, have begun with a pilot project in the Musashino-Mitaka area of Tokyo, in operation since 1984. Although the basic outline for ISDN standards has been agreed upon in the ITU's Consultative Committee for International Telephone and Telegraphy, negotiations continue over detailed specifications. As discussed in chapter 9, the standards-setting process will be contentious, if only because the stakes are so high. Not only will new generations of CO switches and other network equipment be needed, but a wide range of home, office, and industrial equipment will eventually be marketed in ISDN-compatible form—i.e., ready to be plugged into the network. Governments and PTTs will seek an edge for domestic equipment manufacturers.

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[1] For a brief survey of the status of ISDN trials internationally, see T. E. Bell, "Technology '87: Communications," *IEEE Spectrum*, January 1987, p. 42.

When it comes to the second category of VANs, the supplier goes beyond the provision of network access and management, offering a package of end-user services. Examples range from Ticketron, to public VAN suppliers like GEISCO and ADP that provide funds transfer services, to networks of automatic teller machines.

SWIFT (ch. 3) links banks for messages, with the actual funds transferred by other means, while SITA (box R) provides services for airlines. Most of these specialized VANs use dedicated networks of leased lines, with their own switching and processing facilities. SWIFT is currently replacing its original system with a decentralized SWIFT II version based on regional processing centers. (Ch. 3 described the scope and function of the SWIFT consortium in relationship to member banks.) In order to provide the end services its members need, SWIFT has developed standard forms of financial messages that can be sent anywhere in the world without risk of ambiguity, as well as software packages for terminals from a range of manufacturers. The consortium maintains as well as supplies all terminal interface software, in part because security is critical (given that much of the network traffic concerns very large financial transactions).

Growing VAN markets offer U.S. firms strategically attractive—if not yet very profitable—opportunities, with companies like Tymnet, Telenet, IBM, and Computer Sciences Corp. (CSC) already significant international suppliers of VAN services. Some of these firms have expanded from a base in data processing or data communications. For DP service firms such as GEISCO and EDS, and for operators of public data networks such as Tymnet and Telenet, services like electronic mail and airline reservations represent straightforward extensions of older lines of business. Likewise, CompuServe's videotex service is based on its existing DP capabilities. Most of these firms have been seeking to expand internationally.

International thrusts by U.S. VAN providers has generally come only after regulatory barriers have started to fall. In the past, with resale of leased lines prohibited in most parts of the world, DP services firms and networks like Tymnet and Telenet could offer little more than an international connection to their U.S.-based

Box P.—EDS and General Motors' Planned Corporate Network[1]

General Motors paid $2.5 billion for Electronic Data Systems in 1984, even though EDS's annual revenues were less than $1 billion. Why? GM felt it needed help in integrating computer and communications services into its sprawling organizational structure, a job that EDS had specialized in for clients during the years that company was building its DP services business. When it purchased EDS, GM, with a hundred computer centers and as many independent data networks, was spending more than $2 billion per year on its internal data processing and office automation needs.

Founded in 1963, EDS had long been known as a leader in batch and remote processing. Over the more recent past, the company managed to outgrow all the other large U.S. data processing firms. EDS has traditionally negotiated contracts giving it extensive control over clients' DP functions—in many respects, providing facilities management. This sometimes put EDS in the unusual position of an outside firm that had partially penetrated the organization of its clients; the frictions that developed between long-time GM and EDS employees thrown together by the acquisition (GM transferred more than 7,000 of its employees to EDS) have many precedents.

Under GM ownership, EDS remains an independent operating company—in part, an attempt to preserve some of the EDS culture, markedly different from that of its new parent. GM gave EDS responsibility for all the automaker's DP-related operations; EDS will prepare the software for GM's planned worldwide data network system (some of the hardware for which is to be developed by another GM acquisition, Hughes Aircraft, purchased in 1985 for $5 billion). GM aims to integrate all of its computer and telecommunications systems, from vehicle design and engineering through links with dealers. The company will purchase CO switches, rent or buy satellite circuits, and install cable and fiber optic links to enable a network of powerful computers with advanced software to communicate with one another. Eventually, the company's 16,000 dealers, along with some 35,000 suppliers, will be part of a single network also embracing GM offices and plants in some 33 countries. Among its other functions, the network will connect a quarter of a million telephones at GM offices and plants throughout the United States—an example of total system bypass. EDS will handle data processing needs ranging from GM's 40,000 employee health claims per year to a major new generation of automated design and production equipment. The latter, which has proven particularly difficult—in part because EDS has little experience in factory automation—includes the development and promulgation of standards for interconnecting computers, machine tools, robots, and other shopfloor equipment.

This set of standards, termed MAP (Manufacturing Automation Protocol, also see ch. 9), has been accepted by a large number of outside firms—and not only those wishing to sell to GM—because it will allow simple interconnection of a wide variety of equipment. EDS, along with other companies including Boeing (another pioneer in DP services through its Boeing Computer Services division), is also pursuing an initiative called TOP (Technical/Office Protocol), aimed at standardizing interconnections for office automation equipment.

When complete, the GM/EDS system will handle information including the following:

- dealer orders, together with customer financing and insurance information;
- engineering and design data;
- manufacturing data, including software for computer-controlled production equipment;
- accounting, financial, and tax information;
- personnel and payroll data, including electronic funds transfers for wage and salary deposits;
- intra-corporate billings and payments;
- employee health insurance and claim information, along with other fringe benefits;
- government and financial reporting;
- intra-corporate electronic mail; and
- voice message and voice storage service.

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[1] S.T. McClellan, *The Coming Computer Industry Shakeout* (New York: Wiley, 1984), pp. 138-145; F. Barbetta, "EDS Building Com Net for GM," *Electronic News*, May 13, 1985, p. 1; "Large Corporations Develop In-House Networks in Divestiture Aftermath," *Electronic News*, May 20, 1985, p. 1; J. Holusha, "Acquisition Is Expected To Aid G.M. Plans for Diversification," *New York Times*, June 6, 1985, p. 47; "Survival of the Fattest," *The Economist*, Oct. 12, 1985, p. 35; "Electronic Data Systems: Logical Move," *The Economist*, Dec. 21, 1985, p. 94; D.E. Sanger, "E.D.S.'s Prospects In the Aftermath," *New York Times*, Dec. 2, 1986, p. D5.

Box Q.—Telenet

Telenet, established in the mid-1970s, was one of the first public data networks to make use of technology based on the Department of Defense's ARPANET packet switching system. By 1986, Telenet was transmitting the equivalent of more than a million typed pages each day. In the United States, users can tap into the network either through dedicated lines to a host computer or a local telephone call to one of Telenet's dial-up nodes. Telenet also offers services such as electronic mail and credit card verification.

The network makes use of dedicated lines and domestic satellite circuits. With the recent merger of Telenet, Sprint (both previously owned by GTE), and U.S. Telecom to form U.S. Sprint, Telenet will have access to a fiber-optic transmission network that will become the core of its domestic system. The firm provides international access through PTTs (in more than 70 countries) or directly to one of Telenet's international gateways (in 24 nations). In 1983, the FCC designated Telenet an International Record Carrier (IRC); as an IRC, the firm can provide international gateway and network services directly, without going through another international carrier.

Box R.—Societe Internationale de Telecommunications Aeronautiques (SITA)

A cooperative organization of nearly 300 airlines, SITA operates the world's largest specialized telecommunications network. Started in 1949, the SITA network now joins about 16,000 airline offices in more than 1,000 cities. SITA's major switching centers—in New York, Atlanta, Los Angeles, London, Amsterdam, Frankfurt, Paris, Madrid, Rome, Bahrain, Singapore, Hong Kong, Tokyo, and Sidney—make use of dedicated lines leased from common carriers, as well as satellite circuits. In addition to telecommunications, SITA offers its members a variety of data-processing services.

The cooperative's GABRIEL II passenger reservation system, centralized at the Atlanta and London centers, connects with the networks of individual airlines, such American's Sabre, while also providing hotel reservation services, credit card authorizations, baggage and air cargo tracking, flight planning, and weather forecasts from around the world. Some of these services, such as passenger reservations, are in direct competition with those offered by member airlines—e.g., Sabre and United's Apollo. But while the airline networks serve travel agents, SITA does not. Much of the general message traffic—flight safety notifications, information on aircraft movements and lost baggage, reservations and ticket sales—still takes place via telex/teleprinter facilities. But with computer-to-computer traffic growing rapidly, SITA has established a new packet-switched network for data communications.

networks. While this is still the case in most countries, VAN providers can now compete directly with PTTs in a few nations—an opportunity that brings with it risks over and above those of competing with other private firms.

With many government-owned or supported PTTs entering the data network business—e.g. the DGT's TRANSPAC in France—private firms will need to offer differentiated services, given that the PTTs will always be able to undercut their prices. Beyond this, some enhanced services, such as electronic mail, substitute for (and supplement) regulated services or monopoly PTT services, such as telex. A number of specialized VANs, notably SWIFT, were established because the PTTs could not cope with demand; the PTTs permitted SWIFT to bypass their monopoly telex services only because the rapidly growing volume of inter-bank messages threatened to overwhelm them. Private VANs threaten PTTs both directly and indirectly, and some PTTs will no doubt use their power to control or limit VANs that promise to compete too effectively.

As box N suggested, U.S. firms will probably have little choice but to enter many foreign VAN markets through joint ventures with local companies. Of those countries that have already established legal guidelines for VANs, Japan has gone perhaps the farthest in restricting foreign firms to minority ownership. Despite the disadvantages of such arrangements, IBM has chosen to enter joint ventures with NTT and Mitsubishi, Tymnet has established a venture with Hitachi, GEISCO with NEC, and AT&T with a group of 18 Japanese firms.

When it comes to telecommunications, U.S. trade policy has generally focused on opening up foreign markets for American equipment manufacturers. Progress in this arena has been slow, with governments unwilling to abandon policies of sheltering domestic manufacturers, and PTTs to abandon their own ties with these firms. Markets for telecommunications services, in some contrast, seem to promise greater openness, particularly for VAN suppliers.

Lacking the deeply rooted obstacles that slow liberalization in equipment and basic services, VANs will probably evolve in a relatively lightly regulated environment in many parts of the world. At the same time, these services will certainly pose threats to PTTs. With VANs heavily dependent on leased lines, for which they now typically pay flat rates, the first reaction by some PTTs will probably be to raise their charges, or seek regulatory approvals for volume-sensitive pricing. With leased-line policies crucial to the success of VANs, both tariff schedules and possible restrictions on entry (or discriminatory tariff rates) become policies that the United States will need to monitor. Although some countries may eventually allow private firms to install their own lines, bypassing PTT facilities entirely, so far only Britain and Japan (besides the United States) have made this choice.

Videotex

Videotext and teletext—or videotex, referring to both—provide information services ranging from news and weather reports, to business and financial information, teleconferencing, electronic stock trading, on-line shopping, and even computer games. In essence, they are specialized VANs.

Teletext refers to one-way transmission of text—e.g., news information. Typical videotext services—now available over the telephone to anyone with a PC—combine text and graphics interactively. Videotex services differ from information and database services intended for professional and technical markets largely in the type of information provided, with the professional/technical products tending to be specialized and expensive. Many videotex systems provide a single gateway to a wide variety of services, as exemplified by the hundreds of offerings available through Teletel/Minitel in France (box N).

When the videotex business began to grow in the United States during the early 1980s, Dow Jones News Retrieval and The Source each offered a wide range of easy-to-use services, with CompuServe quickly following. These three firms now split the great majority of the U.S. market, continuing to match each other's offerings. Videotex, particularly for household subscribers, has been a domestic business almost entirely; with the more successful products supplied over phone lines to PCs foreign subscribers must be willing to pay high charges. Because cross-border service will probably continue to be expensive, videotex suppliers that wish to penetrate foreign markets will have to invest overseas. In some countries, American firms will probably be limited to providing specialized services to the PTT's own monopoly videotex system.

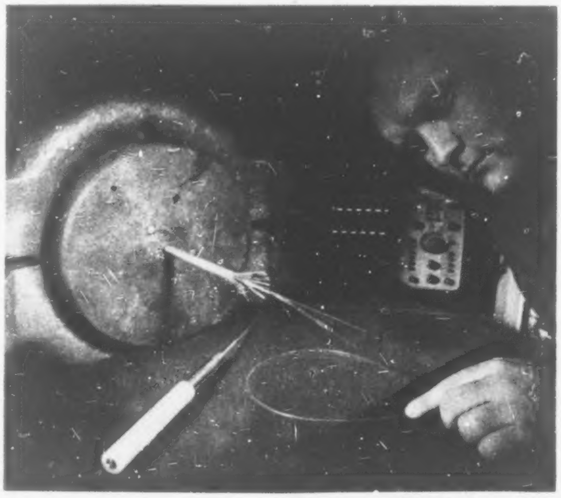

Photo credit: AT&T Bell Laboratories

Optical fibers emerging from pressure vessel simulating deep sea conditions.

DATA PROCESSING AND INFORMATION SERVICES

As the costs of computing equipment dropped, companies that once contracted out some processing began doing more of their own. Widespread availability of packaged software for standardized applications contributed to this trend. While falling data communications costs work in the opposite direction, the DP services industry has nevertheless been suffering from stagnant or even declining demand. The number of firms in the industry has dropped, along with their average size. Information and database services have replaced processing as a growth sector.

The DP Services Industry

With computing applications continually expanding, DP firms have needed to search out ways of keeping ahead of their customers, offering services that will attract even large and sophisticated end-users of computing equipment. As the market for more routine processing stagnated, they have sought new ways to capitalize on specialized expertise or equipment. Beginning with batch processing, and later time sharing, many have diversified into support activities including system design and management. Early entrants like McDonnell Douglas, Boeing, and Martin Marietta—primarily aircraft and aerospace manufacturers—began offering services to take advantage of the experience they had accumulated in their primary businesses. Today, all three are moving, along with other DP firms, into information and network services. Others train personnel for clients, write software, install and maintain large government or corporate computer/telecommunications systems, and provide consulting services to companies contemplating purchase of large-scale systems. Some help firms set up intra-corporate VANs, or increase the efficiency with which they use existing equipment. Others sell time on supercomputers. CompuServe, a remote DP specialist now owned by H&R Block, used its spare capacity to become the leading provider of videotex services to small computer owners. With the hospital market dominated by two well-established companies, Shared Medical Systems and McDonnell Douglas, Amherst Associates carved out a niche by adding financial planning and modeling services tailored for medical centers. For other examples, see box S.

The largest DP firms are American, led by ADP with 1985 revenues of $1.1 billion, EDS at about $980 million, and Computer Sciences Corp., $800 million.[27] As in the software industry, the more typical DP firm, in the United States or abroad, is a relatively small company providing specialized services, but it is the large firms that account for most of the international trade and investment. As table 21 shows, the global market exceeds $26 billion. However, only 2.6 percent of all U.S. DP establishments (173 of 6,700) reported export revenues when surveyed for the 1982 Census of Service Industries.[28] OTA estimates that total foreign DP services revenues of U.S. firms came to $2.7 billion to $5.1 billion in 1984.

The larger DP companies rely heavily on raw computing and telecommunicating power. To compete for processing jobs involving the manipulation of vast amounts of data or very demanding computational problems takes clusters of large mainframe computers, perhaps supercomputers, operating, if possible, around the clock. This in turn leads to marketing approaches that include reduced prices for off-hours business use, and geographical diversification to attract customers from different time zones. Heavy capital equipment costs in this part of the business limit the competition to a relatively small number of firms operating clusters of networked computer centers.

Most of the new international opportunities for DP firms will probably be found in VAN and information services. Companies with an existing network of computer centers will start

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[27] "The Datamation 100," op. cit.

[28] *1982 Census of Service Industries: Miscellaneous Subjects* (Washington, DC: Department of Commerce, December 1985), p. 5-142. Foreign receipts accounted for 8.8 percent of total industry revenues.

For the OTA foreign revenues estimate, below, see *Trade in Services: Exports and Foreign Revenues*, op. cit., p. 62.

Box S.—Data-Processing Service Firms: Two Examples

ADP:[1] The world's largest independent DP services supplier, Automatic Data Processing Inc. (ADP) has been seeking to adapt to marketplace shifts by developing new products based on its traditional strengths. For more than 35 years, the company has specialized in back-office automation—not only accounting and payrolls, but counting, labeling, sorting, and otherwise processing documents including stock certificates, canceled checks, sales receipts, and credit-card slips. Not surprisingly, their strongest competition comes from the in-house DP departments of large firms—one reason for a strategy built around many smaller customers (in contrast to EDS, which gets most of its business from a few big contracts).

ADP began by automating payroll processing for its customers, relying primarily on mechanical sorting and printing machines; by the early 1960s, the firm had become an intensive user of large mainframe computers. Today, nearly half of ADP's revenues come from its Employer Services division: the company handles about 10 percent of all U.S. private sector paychecks. ADP has also been diversifying into front-office brokerage services, as well as processing data for car dealers, banks (including ATM services), and insurance companies. In 1983, the company purchased the stock quotation unit of GTE's Telenet subsidiary, and 2 years later added Bunker Ramo Information Systems, a firm with 30 percent of the on-line stock quotation market. Besides moving aggressively into brokerage services, ADP is trying to win sales in data processing for automobile insurers and repair shops, by, for example, offering a database containing information on 35 million automotive parts to speed repair estimates. The company has extensive overseas operations, particularly in Western Europe, where it has followed generally similar strategies.

GEISCO:[2] General Electric Information Services Co.—established in the early 1960s to operate GE's remote processing facilities—has been a major force in the time-sharing market, as well as in network services. While GEISCO once maintained more than a dozen regional centers and operated several dozen time-sharing systems to supply services to major customers, decreasing data communications costs have led to a more concentrated system. Like other firms with extensive networks, GEISCO has moved its remote processing centers from urban areas into regional clusters servicing numerous cities. Today, the firm operates "supercenters" in Rockville, Maryland, Cleveland, and the Netherlands, where 35 mainframes have recently been replaced by just 11 still more powerful machines.

Because many companies want to link their own systems so that all offices have access to a common corporate database, GEISCO now offers its customers VAN services. The firm has also become a major provider of network services to banks (ch. 3). GEISCO has thus evolved from providing a menu of relatively discrete remote DP services to operating a farflung integrated network with links to customers available through both private and public telecommunications systems. GEISCO has recently purchased several smaller companies to add to its capabilities in accounting/financial software, oil and gas company services, and ATM services.

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[1] "A Number-Cruncher Wants Out of the Back Office," *Business Week*, Dec. 9, 1985, p. 86; P.W. Barnes and A. Monroe, "Automatic Data Processing To Acquire Bunker Ramo From Allied-Signal Inc.," *Wall Street Journal*, Nov. 18, 1985, p. 6; P. Archbold and P. Hodges, "The Datamation 100," *Datamation*, June 15, 1986, p. 95.

[2] OTA interviews; also C. Wiseman, *Strategy and Computers* (Homewood, IL: Dow Jones-Irwin, 1985), pp. 148-151 and "The Datamation 100," op. cit., p. 93.

Table 21.—Data Processing Services Markets, 1986

	Revenues (billions of U.S. dollars)
United States	$19.5
Japan	3.5
France	1.5
Federal Republic of Germany	1.0
United Kingdom	0.9
	$26.4

SOURCE: *1987 U.S. Industrial Outlook* (Washington, DC: Department of Commerce, January 1987), p. 47-1.

with advantages in VAN markets. At the same time, the technological lead of the United States in specialized applications—e.g., use of supercomputers—should mean continuing new opportunities for firms choosing to remain active in this part of the business.

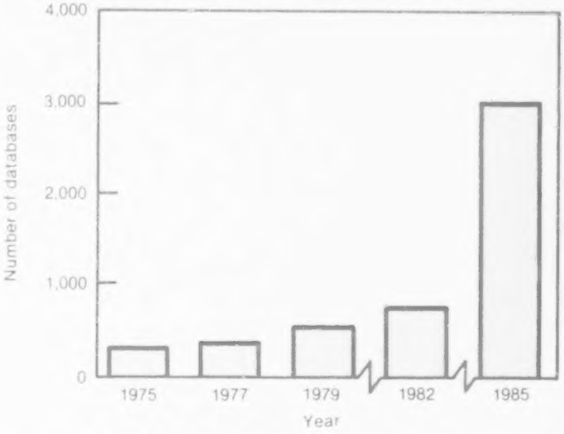
Database and Information Services

This subset of the IT services starts from a much smaller revenue base than data processing, but has great potential for growth—in part through close ties with VAN and videotex markets. Indeed, on-line database services—those available via computer terminals—are simply one type of VAN service. Once again, reduced costs for computer hardware and advances in telecommunications, will make it easier and cheaper for customers to tap on-line databases and for suppliers to provide interactive services (for instance, models for predicting economic growth that the client can exercise under differing assumptions). Figure 35 shows the growth in the number of machine-readable databases available worldwide. The rapidly increasing installed base of PCs, which provide cheap and convenient terminals for many of these applications, has contributed to the swelling demand for database services suggested by figure 35—and also by figure 36, which shows the rise in on-line searches of these databases over the past decade.

With many small computers being purchased for home use, as well as by businesses, two types of products dominate the information services industry:

1. Professional and technical on-line services (Quotron, Mead Data Central's NEXIS/LEXIS, Standard and Poor's COMPUSTAT, Lockheed's DIALOG, Datastream in the United Kingdom and DATEV in Germany), which offer such products as business and economic data, or scientific citations.
2. Videotex or similar services (CompuServe, Dow Jones News Retrieval, The Source), oriented primarily to small business and household users.

Figure 35.—Publicly Available Databases Worldwide



SOURCE: M.E. Williams, "Database Data," prepared for OTA under contract No. 633-3210.

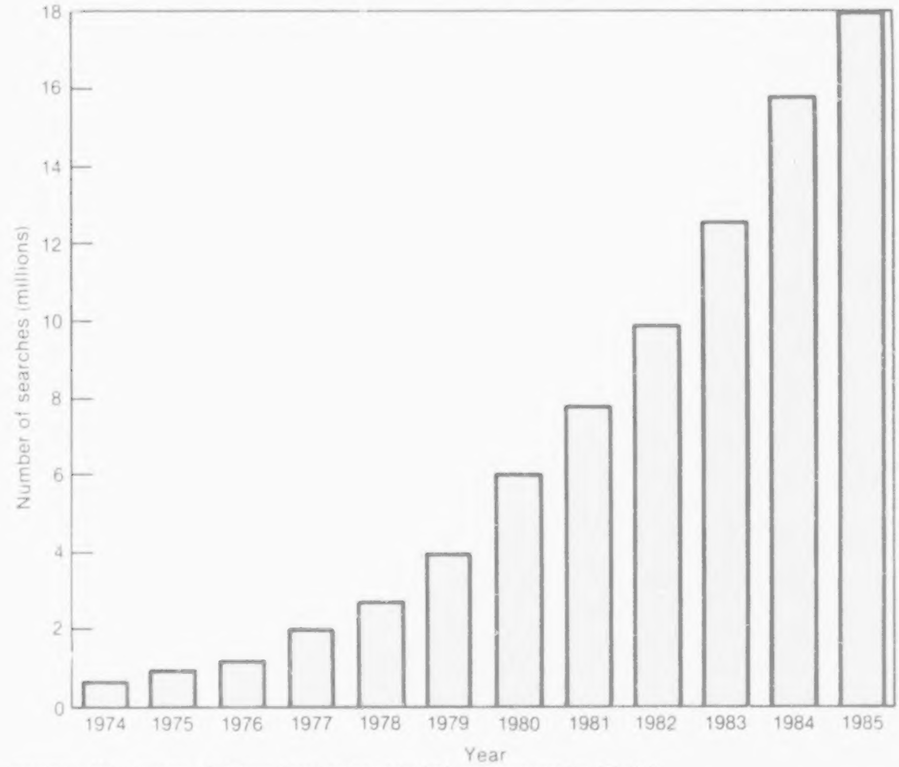
As table 22 shows, professional and technical services remain the largest markets, with credit, financial, and economic information accounting for two-thirds of total industry revenues in 1984.

Table 22.—U.S. Markets for Electronic Information Services

	Revenues (millions of dollars)		
	1984	1989 (projected)	Projected annual growth rate
Business and consumer credit	$ 447	$1,050	19%
Financial	389	720	13
Economic	222	320	8
Legal and government	184	350	14
Scientific	102	220	17
Business news	98	330	27
Marketing and media	69	150	16
Personal and household information services	78	470	43
	$1,589	$3,610	18%

SOURCE: *Electronic Information Industry Forecast, 1984-1989* (New York: LINK Resources Corp., May 1985).

Figure 36.—On-line Database Searches



SOURCE: M.E. Williams, "Database Data," prepared for OTA under contract No. 633-3210.

COMPUSTAT provides detailed firm-specific information of interest to investors. NEXIS supplies the complete text of news stories. LEXIS lists judicial cases and decisions, a service widely used by lawyers and legal researchers. NewsNet, a relatively new full-text service, provides on-line access to over 250 specialized newsletters. Such databases must be constantly updated. They also demand substantial investments in initial design and development. Competitive success depends on understanding the needs and demands of end-users. Firms that have grown up supplying information services in print form have sometimes had trouble moving into electronic database markets, as illustrated in box T. Staff must be retrained and people with new skills—e.g., in computer systems—hired. The design phase tends to be especially demanding.

As figure 37 shows, two-thirds of all databases available on world markets originate in the United States. The number of on-line databases available from U.S. sources grew by a factor of 10 over the years 1977 to 1985, from 212 to 2016; those originating in the rest of the world increased more slowly, from 154 to 824.[29] Nearly 20 percent of the revenues of U.S. database suppliers come from foreign sources, three-quarters from Europe. The Japanese market for on-line services, like that in Europe, has been

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[29] "Database Data," prepared for OTA under contract No. 633-3210 by M.E. Williams.

On the foreign revenues of U.S. suppliers, see *A Competitive Assessment of the U.S. Information Services Industry* (Washington, DC: Department of Commerce, May 1984), p. 23. Half or more of database services in Europe are supplied by U.S.-based firms. On Japan, see "Info Industry Expanding Rapidly," *Japan Economic Survey*, September 1986, p. 12.

Box T.—Moving Into New Information Markets: InfoBase Corp.[1]

InfoBase Corp. (IBC) supplies bibliographies, indexes, and related services to scientists and technologists around the world. The company, established many years ago, has distributed its products mostly in printed form, selling primarily to libraries in universities, large corporations, and government agencies.

IBC staff receive some 8,000 technical journals. Through a systematic pre-editing, coding, and keypunching process, each article is given a unique access number and address in the firm's computer system. For scientific indexes, some of the critical text abstraction work is performed at IBC's Bombay offices. Scientists stay with the firm longer in India than in the United States, particularly important to the company because of the high costs of training in IBC methods.

While the company's managers do not feel that IBC has fully exploited the potential market for its traditional products, they recognize they must develop new products as well. "Somewhere there is a company controlling just about every type of document being published," noted one senior manager. "I don't think we can only do more of the same." Another added, "The new anxiety is that scientists feel they have too much brought to their attention already. The need is for a level of interpretation layered on top of the data." IBC has begun to experiment with three new approaches: software search tools that complement its print and on-line database products; custom databases; and interpretive or editorial products:

- *More Complex Search Tools*—IBC has developed and begun to market a software search aid that helps users sift through many databases without the need to learn specialized methods for each. The system contains a file manager with which the user can create a personalized bibliography while offloading references from each database. IBC must develop new ways to sell this product. The company's print products were subscription items, relatively self-explanatory and inexpensive. Software, in contrast, requires active selling. The package is perceived as expensive; customers must also invest time in learning to use it. "People lack confidence," one manager said. "They know they should buy the product, but its a major investment. We have to do a lot of personalized education, which is expensive for us." The educational effort does not end with a sale. IBC has trained a group of customer service representatives to trouble-shoot problems and help customers use the system.
- *Custom Databases*—IBC has sought to market specially-tailored databases to corporations, academic institutions, and government agencies. Again, this has posed difficulties. One IBC manager said, "Our sales force needs to break out of the library, and begin calling on other places where research is done—or where there is a need for information, such as stockbrokers and group health practices." But another noted, "We can't just send our sales reps out to industry without retraining. They're too academically-oriented." It has also proven difficult to estimate the cost of customizing a data tape for a customer.
- *Interpretive Tools*—Here, IBC has introduced a new series of products—an encyclopedia of science. Again, the company has been faced with a good deal of new learning. Its standard citation indexes are entirely objective in structure. Interpretive work means that IBC must hire writers with legitimacy and standing in the scientific community. The company has set up advisory committees of well-known scientists to help it penetrate the social network of researchers and scholars.

As these examples suggest, in moving into new, high-value-added information products, IBC must:

- retrain its sales force so that they can deal with a broad spectrum of customers, and with more complex purchase decisions;
- put together a new force of customer service representatives, who can help scientists directly, as well as deal with librarians and information specialists;

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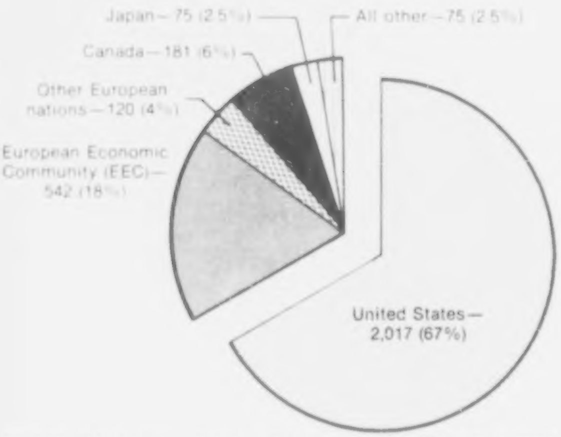
[1] Drawn from a case study prepared for OTA under contract No. 533-5970 by L. Hirschhorn. The name of the company, and some of the details, are fictional.

- develop a better understanding of how and why different end users acquire and utilize information; and
- extend and deepen the company's existing ties to the user community, so that its interpretive work will be accepted.

For IBC, this means a new product development and marketing strategy, one based on deeper understanding of its customers needs, along with a more active and sophisticated sales effort.

Figure 37.—Publicly Available Electronic Databases by Country of Origin, 1985



SOURCE: M.E. Williams, "Database Data," prepared for OTA under contract No. 633-3210.

growing rapidly. Currently, almost 80 percent of the databases available in Japan originate elsewhere. Continued expansion of videotex systems will drive growth in markets for database and information services.

As the costs of international telecommunications continue to decrease, and more countries begin to deregulate value-added services, further opportunities for American firms will emerge. Under such conditions, U.S.-based suppliers should be quite competitive, particularly those that remain sensitive to the more specialized needs of overseas users. The major policy issues likely to arise center on possible TBDF restrictions, questions of customs valuation, and protection for the intellectual property embodied in information services—as summarized below and discussed in more detail in chapter 9.

CONCLUDING REMARKS

U.S. firms have been highly competitive in the major IT services. Traditional data processing has become a relatively mature business, but software, telecommunications, and information services are in the midst of rapid growth and rapid technological change. In computer software, the United States leads the world. Trade will grow as packaged programs take over from custom software. This shift will help foreign suppliers, particularly the Japanese, in their efforts to catch up with American software firms. Liberalization of VAN markets, reduced costs for telecommunications, and steadily growing reliance by companies doing international business on both intra- and interfirm data communications point to growing telecommunications trade as well. U.S. firms offering enhanced services—e.g., VANs—should benefit. So should American DP firms, which remain highly competitive even as they seek new lines of business. Videotex, database, and other information services—all closely related to VAN services and likewise a U.S. strength—will be perhaps the fastest growing of all the IT services over the next 10 or 15 years.

Still, it would be most unfortunate if the competitive strength of the United States led to complacency, particularly in terms of policy. The American software industry faces competitors that benefit from foreign government supports and subsidies. Weak protection for intellectual property, making it easier to copy U.S. products, also aids foreign firms. Software is expensive to develop and cheap to produce; illegal copying and counterfeiting have been endemic. For reasons outlined in chapter 9, current forms of legal protection seem inadequate. Indeed, intellectual property issues cut across many of the IT services.

A multiplicity of technical standards issues also emerge in the IT services—for ISDN, for computer interfaces, for programming languages. Given the PTT monopolies on telecommunications that still exist in most parts of the world, governments will have a major say in technical standards for ISDN—standards that will influence competition in world markets for equipment as well as services. If different parts of the world (or different regions in the United States) adopt different standards, the transition to ISDN will be more expensive.

TBDF restrictions may become a factor in more countries, along with pricing that works to the disadvantage of American firms. In the United States, congressional decisions on regulation/deregulation of telecommunications will have international ramifications. Countries that restrict transborder flows of data, although they may rationalize such policies in terms of privacy, typically seek little more than new tools to influence patterns of trade and investment (ch. 9). In the absence of major new efforts to impose TBDF restrictions abroad, the issue has receded somewhat, but it will probably reappear —if only as a reaction to continuing growth in international data communications and the fears this will create among some people and groups. Moves toward volume-related pricing could likewise prove troublesome, if foreign PTTs continue to propose pricing schedules based on the volume of data transmitted, rather than connect-time (ch. 9).

International trade in telecommunications services remains fairly small in value—seemingly disproportionate to the policy debates concerned with satellite communications or TBDFs. One reason for the heat generated by these debates is simply that new services, notably VANs, will be more tradeable than traditional services, especially if major industrial nations continue to liberalize their internal markets. Beyond this, telecommunications has become a locus of concern for European governments worried that their high-technology goods and services industries are losing the ability to compete with the United States and Japan; policymakers in Europe may be willing to pay a considerable price in terms of efficiency in the name of jobs in telecommunications.

All the IT services depend on computing capability in one way or another. The global market for computer hardware and software, already well over $100 billion, has, despite a recent slowdown, been growing at close to 20 percent annually for many years; worldwide markets for telecommunications equipment are comparable in size. But IT services (and equipment) have significance for the creation of wealth and employment going well beyond their direct impacts: competitive success in other manufacturing and service industries will depend heavily on the IT services. The links are perhaps most obvious for the many consumer and producer goods that embody smart electronics, and therefore software. Software development costs are growing as a fraction of total development costs for applications of computing power, wherever these are found. Indeed, software today is the primary determining force in the design of many digital systems.

Other links stem from the growing use of computing and telecommunications services for managing dispersed manufacturing and service activities both within and across nations —in turn, a function of the greatly decreased cost of hardware. The General Motors corporate network described earlier provides one example; chapter 8 includes many others. Finally, as pointed out in chapter 3, banks now use online databases to help manage risks on investments and currency transactions, while electronic clearinghouses and expert systems for securities trading are moving swiftly ahead. Although only relatively large companies can afford many of these applications today, in the future, marketed VAN services of comparable power and usefulness will be available to companies regardless of their size. The point is simple: continuing U.S. competitiveness in the IT services will be critical for maintaining U.S. competitiveness in a wide range of other manufacturing and service industries.

Nonetheless, although many American companies—as well as those with headquarters in Europe and Japan—know that adoption of new information technologies will, in some sense, be vital for future success, few at present have a very clear view of which technologies should get the highest priorities, and of how to integrate new services into their ongoing operations. In the United States, the deregulation of telecommunications has contributed to the confusion by suddenly increasing the number of options. Over the next few years, any firm operating in international markets will likely feel pressured to at least match the investments and innovations adopted by its competitors.

Companies will eventually learn to effectively use local and wide area networks for linking geographically dispersed operations; some will link their computer systems with those of their customers. In such ways, new information technologies are changing old industries—a process that can be termed dematuration. Take, for example, the shoe industry. Shoe producers in industrialized countries now compete with those in low-wage, less-developed countries by using computer-aided design and manufacturing systems (CAD/CAM) to speed product development and styling changes, and to reduce costs; small incremental changes in the design, say, of athletic shoes can help a firm respond to or create shifts in demand. Design changes can be transmitted via data communications links to a plant in Asia. The firm can quickly acquire and analyze information on market trends using data from point-of-sale terminals in retail outlets. Managers can correlate sales information with that on shipping and distribution to monitor stock levels. The IT services play a crucial role in these dematuration processes, in this and other industries.

In U.S. automobile production, to take a different example, perhaps the most vital impacts of information technology have been in reducing design/development time for new vehicles.[30] Twenty-five years ago, a new car could be designed and brought to production in little more than a year; since then, the design cycle has stretched to 5 years or more. In attempting to keep up with their Japanese competitors, who have been flooding the U.S. marketplace with a seemingly endless stream of new products, American automakers have turned to computer-intensive design and engineering methods, as well as computer-aided manufacturing. These strategies hinge on networking and communications among hundreds or thousands of terminals having access to common databases.

National security offers a final set of examples illustrating the critical nature of the IT services. During the 1950s and into the 1960s, the U.S. computer industry gained its position of world leadership in large part as a result of spending by the U.S. Department of Defense. Much of this spending, for R&D as well as procurement, went toward early warning systems, intended to detect possible attacks by aircraft and rockets. Today, military systems of many types—from fire-and-forget missiles, to aircraft flight controls, to the planning for the Strategic Defense Initiative (SDI)—depend on digital systems technology.

Missiles like the Exocets that threatened the British navy in the Falklands War, and the laser- or wire-guided rockets that are becoming standard equipment for the foot soldier, have already had major impacts on conventional military tactics and strategy, not to mention nuclear strategy. Strategic command and control, guidance systems for ballistic and cruise missiles, the Navy's submarine tracking systems, military satellites—all demand advanced IT technology, including man-machine interfaces and software that can determine what information is important, how it is displayed, and in some cases what it means. Pilot's aids in future aircraft will extend the capabilities of military fliers, helping them cope with information overload and maneuvers at and beyond their skill envelopes. Beyond this lie not only the daunting SDI software and hardware requirements, but the quite different needs of huge data-intensive information systems such as those of the National Security Agency.

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[30] See the articles in the March 1986 issue of *Automotive Engineering*.

Chapter 6

Technology Trade: Licensing by U.S.-Based Firms

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Chapter 6

Technology Trade: Licensing by U.S.-Based Firms

SUMMARY

Corporations trade in technology in world markets just as they do in other services and goods—that is, they trade in the knowledge used to produce other goods and services. Mostly this is proprietary technology—knowledge that a firm can control, much of it protected under U.S. law if not always under the legal systems of other countries. Traded technology includes management methods and techniques, as well as knowledge embodied in equipment, in manuals and specifications, patents, in computer software. It also includes disembodied knowledge—know-how that exists only in people's heads or in organizational routines. Today, licensing agreements may be part of complex business arrangements that include equity participation by the licensor, training for the licensee's employees, and contracts to supply parts or components and buy back finished goods. Licensing is becoming an integral part of the international business strategies of American corporations, rather than a means of generating incremental profits from a company's store of technical knowledge.

Compared with other items in the U.S. balance of payments, international licensing is not a big business. Foreign technology sales by American firms, measured by royalties and licensing fees, amounted to $5.8 billion in 1985 (table 23). By value, transactions between U.S.-based parent companies and their overseas affiliates exceed those between unaffiliated firms. Receipts from affiliates account for about 70 percent of U.S. licensing revenues, although making up only 10 to 20 percent of the number of agreements.[1]

Table 23.—U.S. International Receipts, Payments, and Net Receipts of Royalties and Licensing Fees (billions of dollars)[a]

	Receipts	Payments	Net receipts
Licensing between affiliated firms:[b]			
1978	$2.7	$0.4	$2.3
1980	3.7	0.3	3.4
1982	3.5	0.3	3.2
1984	3.9	0.6	3.3
1985	4.1	0.5	3.7
Licensing between unaffiliated firms:			
1978	$1.2	$0.3	$0.9
1980	1.3	0.3	1.0
1982	1.7	0.3	1.4
1984	1.6	0.4	1.3
1985	1.7	0.4	1.3
Total, affiliated plus unaffiliated:			
1978	$3.9	$0.7	$3.2
1980	5.0	0.6	4.4
1982	5.2	0.6	4.6
1984	5.5	1.0	4.6
1985	5.8	0.8	5.0

[a] While far from perfect, the data collected by the Bureau of Economic Analysis (BEA, part of the Department of Commerce)—summarized in table 23 and used elsewhere in the chapter—are the best available. Throughout this chapter, OTA utilizes BEA's data on "royalties and licensing fees" as a measure of technical licensing. The broader BEA category "royalties and fees," though more commonly used, includes management fees and a variety of other charges that may have little to do with technology trade. The royalties and license fees series, as presented in this table, shows significantly different trends than, for instance, the international technical licensing series published by the National Science Foundation in their biennial *Science Indicators*. OTA's choice conforms with BEA's practice, beginning in 1986, of separating "royalties and license fees" and "other private services from affiliated foreigners" in the balance of payments statistics.

For BEA's collection procedures, together with the possible sources of error and ambiguity, see *Trade in Services: Exports and Foreign Revenues* (Washington, DC: Office of Technology Assessment, September 1986), pp. 29-30; pp. 83-85 summarize the impact of licensing on the U.S. balance of payments.

Net receipt figures may not add because of rounding.

[b] U.S. affiliates, as defined by the Department of Commerce, include all foreign firms with 10 percent or more of equity owned by a U.S. parent. The data make no distinction between minority (10 to 50 percent) and majority ownership, although this distinction has important practical implications for control over the affiliate, and thus for licensing arrangements.

BEA presents affiliated licensing data only on a net basis. That is, the affiliated receipts in the table equal payments by subsidiaries abroad to their U.S. parents minus payments by these parents to their subsidiaries. U.S. affiliated payments equal payments by U.S. affiliates to their foreign parents minus their receipts from those foreign parents. In 1982, payments by U.S. parents to their subsidiaries came to less than 2 percent of the receipts of these parents. For affiliated payments, the difference is more substantial. In 1980, payments flowing from foreign parents to their U.S. subsidiaries came to about 12 percent of the payments of U.S. subsidiaries to their parent firms.

The affiliated payments series were revised for 1980, and again for 1982 and later, and may not be directly comparable with earlier years.

SOURCES: **Receipts and unaffiliated payments, 1978 and 1980**: Department of Commerce, Bureau of Economic Analysis, unpublished statistics, January 1986, table 6—U.S. International Transactions in Royalties and Fees, with telephone corrections. **Affiliated payments, 1980**: *Foreign Direct Investment in the United States, 1980* (Washington, DC: Department of Commerce, 1983), table L-1, p. 198. **1982-85**: R.C. Krueger, "U.S. International Transactions, First Quarter 1986," *Survey of Current Business*, June 1986, p. 43.

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[1] F.J. Contractor, *Licensing in International Strategy: A Guide for Planning and Negotiations* (Westport, CT: Quorum Books, 1985), p. 27. In 1977—the latest year for which such data are available—American corporations had 23,600 overseas licenses in force, 3,500 of them (15 percent) with affiliated foreign firms (those owned 10 percent or more by an American company—see table 23, footnote b).

Much of the analysis in this chapter is based on interviews conducted by OTA staff and contractors.

Particularly for transactions between majority-owned affiliates, the dollar values in table 23 do not necessarily mean much; intra-corporate charges may have more to do with, say, minimizing worldwide tax liabilities than with the market value of the licensed technology. At the same time, license fees represent only a small fraction of the foreign sales generated through applications of the transferred technology. Assuming royalty rates at 5 percent of sales, not untypical, U.S. technology licensing would lead to some $116 billion in foreign product sales, a figure more than half of total U.S. merchandise exports ($214 billion in 1985). Viewed as an alternative means of exploiting proprietary technology, then, licensing has great significance for American businesses. Many licensing agreements also lead to exports of capital goods, components, or materials.

As table 23 indicates, American companies also purchase technology developed overseas, but in small amounts compared with their exports. This picture is changing, more slowly than it probably should. Today, few U.S. firms enjoy technical positions so strong that they could not benefit from selective acquisitions of foreign know-how. U.S. advantages in technology have not only narrowed, they have, in more than a few fields, vanished. Some American companies realize how much they can learn from foreign technical developments; others do not. For a growing number of U.S. firms, acquisition of foreign technology has become an important element of corporate strategy, as a substitute for or complement to internal research and product development. The steel industry provides many recent examples, with Nippon Steel, for one, providing technical assistance to USX (formerly U.S. Steel), Armco, and Inland. Technology exchanges with Japan have also been common in microelectronics and robotics.

What does international competitiveness mean in terms of licensing? On one level, licensing can be viewed as an international business in its own right; in a very real sense, American firms compete with rivals abroad in selling technical information. Their ability to compete depends on the U.S. technology base, on relative rates of technological development in this country and abroad, and on the entire array of factors influencing the Nation's store of technical knowledge.

At the same time, licensing—as a vehicle for transferring technical information—can cause changes in the competitive positions of the industries that buy and sell technology. American firms licensed a great deal of microelectronics technology to Japanese manufacturers during the 1960s and 1970s, reducing the time required for Japan to become internationally competitive. The obvious question follows: Have American firms licensed their technology too cheaply? Put differently, while licensors presumably look out for their own interests, is there any reason to expect them to account for impacts, possibly adverse, on other companies in their own industry or in other American industries? The costs and benefits for the three fundamental alternatives—licensing, exports, direct investment—may differ considerably from the perspective of the firm with technology to exploit and from the perspective of the U.S. economy as a whole. More than one executive has been moved to accuse his counterparts in other U.S. companies of giving away the Nation's technological advantages through too liberal licensing.

At the same time, in a world of sprawling multinational corporations (MNCs), questions of *national* technological position quickly become fuzzy. Most international licensing (by value) is carried out between the divisions of such companies (table 23); licensing has become an integral part of global competitive strategy for multinationals. If a U.S.-based MNC has investments in several dozen countries and garners half or more of its sales overseas, does its store of proprietary technology count as U.S. know-how? Some of it does, but probably not all. At the most fundamental level, it is people who embody and convey technical knowledge. R&D carried out by the MNC's employees in the United States counts in the U.S. technology base; R&D conducted overseas may be transferred back to the United States, or may not be. The real point is that the MNC has a good deal of control over its technology, nations with open economies have relatively little; the U.S.

Government can support R&D, adding to the Nation's technology base, but, as a government, has only limited means for retaining that technology within U.S. borders. It may be more important (and more practical) to pursue policies aimed at drawing in foreign technologies than to pursue policies aimed at slowing the outflow of U.S. technology.

Arms-length licensing transactions with both industrialized and newly industrializing nations raise questions of technological comparative advantage most starkly. The issues concern the sources of technical knowledge, the ability to preserve and take advantage of proprietary technology, including the learning and other dynamic effects so important in competitive outcomes, and the Federal Government's role in supporting R&D and technology development. They range from needs for better research equipment in the Nation's universities, to international regimes for protecting intellectual property, to foreign government policies aimed at inducing American companies to license or otherwise transfer their technology. In many countries, trade barriers make it difficult or impossible for American firms to export directly. Governments may also restrict investment by American firms, cutting off the option of local production. Since the 1960s, foreign governments have become far more sophisticated in bargaining with multinationals; integrated corporate strategies have been, in part, a response to foreign government efforts to extract technology.

For a variety of reasons, explored in this chapter, the technological leads once enjoyed by U.S. firms have diminished substantially. This relative decline carries implications both for international licensing, and, from a competitiveness point of view, for sales of knowledge-intensive products and services. The evidence also points to a decline in R&D productivity in the United States—i.e., that a given expenditure for R&D yields less in terms of commercial innovations than in the past. The implication: both industry and government need to seek ways of improving efficiency—e.g., through better mechanisms for transferring technologies from laboratory to marketplace. Furthermore, given that improving productivity in R&D has never been easy, steady increases in U.S. R&D funding seem necessary. Although the focus in this chapter remains on technology development in the private sector, Federal agencies fund nearly half of all U.S. R&D; government policy initiatives offer many opportunities for improving the Nation's technological competitiveness.

That foreign companies have made relative gains in their capacity to generate commercial technologies should come as no surprise. Most have been and continue to be substantial purchasers of technology from the United States. While some critics take this as meaning that American firms remain their own worst enemies, the evidence suggests otherwise. Before the Second World War, European industries held the lead in many technologies (ranging from chemicals to automatic lathes to prestressed concrete). Japan had a well-developed industrial base by the beginning of the 1930s. After the war, American firms were much better placed to compete, but as Europe and Japan rebuilt, their companies quickly narrowed the gap. In newer fields, those that have opened since the 1960s, the Japanese have been able to enter on a par with American firms, and to keep up or even move ahead. Examples include optical communications and structural ceramics.

Today, companies in Europe and Japan operate with state-of-the-art technologies. Japanese firms now license out more technology than they license in, although Japan continues to be a net importer of technology in terms of ongoing agreements. Indeed, the United States may now have as much to gain as to lose through freer exchanges of technical information. Improving the climate for such exchanges, so that American firms can learn more easily from foreign know-how, will require a shift in U.S. attitudes, along with policy changes in other industrialized nations.

The following points, then, emerge most strongly from the analysis in this chapter:

- In an increasingly integrated world economy, U.S. companies license both at arms-length and to their affiliates. The affiliates themselves license—their own technology, as well as know-how they get from the parent. Technology flows around the world through many channels. Almost any technology will be available to almost any firm with the money and skills to make use of it.

- With licensing a part of business strategies in which joint ventures and other intercorporate alliances have become common, it makes less and less sense to speak of U.S. technology as compared with foreign technology. Corporations control technology when they can; certainly they maintain storehouses of proprietary knowledge. But, granting some exceptions, nations do not.
- Given that many foreign corporations, particularly those in Japan, now have technologies in some respects as good or better than those of American companies, the U.S. economy could benefit from greater inward flows of technical know-how. Access to the *world's* stock of technology is quickly becoming an issue comparable in significance to the ongoing task of supporting R&D and technology diffusion within the United States. Some U.S.-based firms do seek out and license technologies from overseas, but a broad shift in attitude toward foreign know-how on the part of American corporations seems called for.
- Into the 1970s, many U.S. firms underestimated the capabilities of their potential rivals in Japan, and therefore settled for royalties that experience shows to have been too low. While most of these mistakes are in the past, it remains true that firms look out for their own interests; they do not, in general, look out for the interests of other American companies or for broader U.S. economic interests. The greatest need, at this point, is to develop more effective mechanisms for bringing Japanese technology into the United States.
- Finally, the U.S. technology base as a whole plainly needs attention. Policymakers have acknowledged many of the problems for years: obsolete and inadequate university research facilities; too few American-born graduate students in engineering (and an infrastructure for technology development that increasingly depends on foreign nationals); inadequate mechanisms for transferring technical knowledge from those who have it to those who need it. Despite much talk, little has been done. More serious strains also seem to be emerging: recognition that military R&D spending yields far fewer spillovers on the civilian side of the economy than once expected; evidence of slowdown in R&D productivity; realization that corporate and national priorities here put less weight on developing and using technical knowledge than in other countries.

INTERNATIONAL TECHNICAL LICENSING

Why License?

A company can profit internationally from its technology by licensing to firms abroad, as well as through exports that utilize the technology, or through foreign direct investment (FDI). Seldom would managers put licensing at the top of the list for exploiting their technology in foreign markets. If the company's know-how gives it a competitive advantage, they will want to retain control—much easier within the firm than outside it. Licensing agreements are notoriously difficult to police, and unauthorized actions by licensees not uncommon. Thus managers tend to be quite careful about which technologies they will license, and the conditions for external use. Even when a company builds a plant overseas, it will often choose a legal contract to help safeguard proprietary knowledge, rather than transferring technology informally, particularly with partially owned affiliates.

Beyond these considerations, markets for technology do not work as well as product markets. Buyers and sellers have trouble finding each other. Proprietary technologies may be available from only one firm, with a scattering of near and not-so-near substitutes; with few buyers and sellers for a given technology, pricing becomes uncertain. Neither party—but particularly the potential buyer—can have a very clear idea of a technology's worth. Considerable adaptation and re-engineering may be needed before technologies developed in one company can be used in another; these costs—which may be high and uncertain—reduce the potential returns. For such reasons, the determining factors in setting royalty levels and the rest of the compensation package may be rules of thumb, negotiating skills, and relative bargaining power more than the value of the technology as it would be established in a better developed market. It should be no surprise that less developed countries (LDCs) often complain that they must pay "too much" for technologies, or that some U.S. firms will not license at all outside their own organization. Box U summarizes some of the characteristics of typical licensing agreements.

Despite the difficulties of negotiating mutually satisfactory agreements, licensing revenues continue to increase, as table 23 showed. Why? For three primary reasons:

- First and most important, American companies license abroad when this is the only alternative for exploiting their technical advantages. Trade or investment barriers may restrict foreign investment to minority positions, or foreclose exporting and FDI entirely. (Licensing in Eastern Europe has turned out to be a lucrative business for some American companies.) For smaller firms lacking export experience or an international division, licensing may be the only practical route.
- Second, firms may have other options but nevertheless choose licensing for strategic reasons. Licensing can be a good way to test the waters in an unfamiliar market, or earn revenues in smaller countries or those where political risks are high. Moreover, MNCs have come to view licensing as a valuable tool in crafting complex international strategies. For example, American firms have licensed manufacturers in South Korea and Taiwan to help create stronger competition in the Far East for Japanese firms, as discussed later in the chapter.
- Licensing *within* the corporation, finally, takes place for a variety of reasons—all of which come down to efforts by the firm to manage international operations rationally. For instance, licenses help with accounting and management control: the division that develops the technology gets the credit. Most important, licensing agreements provide useful mechanisms for transferring funds internationally—mechanisms that may be available even when governments block other flows of funds, or enforce unrealistic foreign exchange controls.

U.S. Receipts and Payments

Foreign investments by American companies have been heavy during the postwar period, with many firms transferring technology to support their overseas manufacturing operations. In 1985, payments from affiliated foreign companies accounted for 70 percent of U.S. licensing receipts ($4.1 billion of the $5.8 billion total, table 23); payments by U.S. companies totaled only $847 million. But as the table indicates, the Nation's surplus on royalties and licensing fees grew only slightly during the 1980s.

Figure 38 shows that licensing with other industrialized countries accounts for the great majority of U.S. revenues; only 5 percent of affiliated receipts come from LDCs, and 17 percent for unaffiliated receipts. Payments by Japanese and European firms accounted for three-quarters of receipts from affiliates and over half from unaffiliated companies.

While capturing the general patterns, table 23 and figure 38 do not convey a full picture of U.S. licensing. First of all, BEA's data cover all licensing fees, for both new and ongoing agreements. With the average length of agreements in the vicinity of 10 years, trends are slow to emerge; neither the number of new agreements in a given year, nor their value, can be isolated. Second, BEA does not collect data on the value of licensing agreements for which no royalties are charged. In industries like electronics, where cross-licensing is common, com-

Box U.—The License Agreement

When technology is transferred, either domestically or internationally, a formal contract will normally set out the obligations of buyer and seller. The license agreement conveying technology to the buyer sets the conditions on its use—e.g., requiring the recipient to maintain quality standards, limiting the geographical markets in which the technology can be used, prohibiting resale. Compensation can take a variety of forms: a one-time fee; royalties set at a percentage of the licensee's sales; a reciprocal technology transfer; even an equity shareholding in the firm receiving the technology. With the agreements becoming more thoroughly integrated into the ongoing businesses of MNCs, many contracts today incorporate combinations of these payment forms.

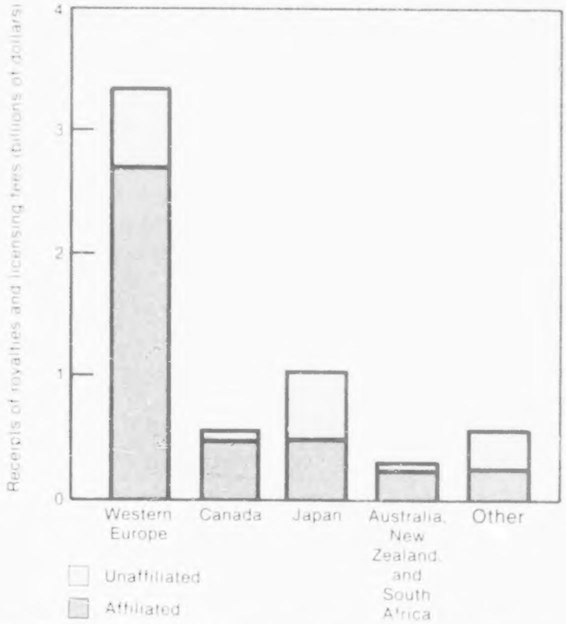
Most license agreements cover fixed terms, commonly in the range of 5 to 20 years. Royalty rates vary a good deal, and may be less than 1 percent of sales in the petroleum industry but 15 percent or higher in pharmaceuticals. Given the poorly developed markets for technology, industry norms have a good deal of influence over royalties. Typical rates range downward from 10 to 15 percent in the pharmaceutical industry, to 3 to 5 percent in computers, 2 to 3 percent in chemicals (other than petroleum), and around 2 percent for many consumer products sectors. The rates also vary with other contract provisions; automakers may get royalties of no more than a quarter of a percent, but earn substantial profits from sales of parts and subassemblies to firms that assemble their vehicles under license.[1]

In the simplest case, the agreement gives the licensee the rights to a patent, conveying no other technical information. Because patents are public knowledge, the license amounts to an agreement that the licensor will not sue for infringement. (While copyright and trade secret law, as well as patents, provide protection for intellectual property in the United States, these protections may be much weaker in other countries—one reason so much licensing takes place between companies that share ownership ties.) The great majority of agreements, however, are designed to transfer technology in a broader sense: the licensing package may convey knowledge in the form of technical manuals, engineering data, manufacturing specifications, administrative procedures and management techniques, trade secrets, and—particularly if the licensee is inexperienced or the technology complex—technical training and assistance. Transferring technology can be a difficult and costly business; often, disembodied or tacit knowledge can only be passed along through experience-based learning, with the licensor's employees working alongside those from the licensee.

Licensing agreements demand management attention past the point of negotiation and transfer of technology. Each party has an interest in the continuing technical capabilities, markets, and strategic plans of the other. One former executive of a large American multinational recalled in an OTA interview a meeting with a group of Japanese representatives to discuss a new licensing agreement between the two firms. The Japanese came prepared with a report summarizing the 300 existing agreements between the two companies, leading the Americans to conclude that their counterparts knew far more about the relationship between the two companies, and were in fact managing that relationship in ways the Americans had not begun to think about.

[1] Most contractual royalty rates probably fall in the range of 1 to 8 percent of sales—*Licensing in International Strategy: A Guide for Planning and Negotiations* (Westport, CT: Quorum Books, 1985), pp. 9, 75, 222. See pp. 106-109 for survey results on the content of licensing agreements, showing, for example, that the great majority of licensing agreements make explicit provision for technical assistance to the licensee.

Figure 38.—Geographic Distribution of U.S. Technical Licensing Receipts, 1985



SOURCE: R.C. Krueger, "U.S. International Transactions, First Quarter 1986," *Survey of Current Business*, June 1986, pp. 65-66.

panies may trade a great deal of quite valuable technology with no money changing hands. Finally, there is little information on technology transferred by the overseas affiliates of American firms, which themselves license to perhaps another 10,000 foreign firms.[2]

As noted, growth in the U.S. surplus on licensing slowed during the 1980s, primarily because receipts increased by only $800 million from 1980 to 1985 (table 23). Payments by U.S. firms for foreign technology, although still much smaller than receipts, have been rising. Unfortunately, it is hard to tell how fast inward licensing has been increasing, because of the cumulative nature of the statistics; these, as pointed out above, lump new agreements together with payments for licenses negotiated 10 or 20 years ago.

Many other indicators do provide evidence that foreign firms have been catching up technologically. For example, U.S.-based MNCs now transfer technologies to their affiliates much earlier in the product cycle than in the earlier postwar period.[3] Such trends, together with past OTA assessments dealing with specific technologies and/or industries, show that the U.S. lead in technology has already narrowed dramatically (and in some cases vanished). For the most part, the reasons lie in steadily improving technical abilities in other parts of the world, rather than lagging investments in U.S. R&D. But it seems plain that the United States needs to look to its technology base. In industries ranging from steel to microelectronics to automobiles, higher priorities for commercial technology development could have helped the United States deal with competitive problems. Private industry did not make these investments. This suggests, in turn, that if maintaining the competitiveness of U.S. industries is to be a concern of the Federal Government, then policymakers must seek incentives for encouraging private sector R&D, as well as for diffusing the results to American companies. Analysis later in this chapter indicates that strengthening the Nation's technological advantages should be a high priority for U.S. policymakers.

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[2] According to a 1977 survey, the latest available, U.S. affiliates abroad licensed to another 5,500 affiliated foreign firms and to 4,600 unaffiliated enterprises. See *U.S. Direct Investment Abroad, 1977* (Washington, DC: Department of Commerce, 1981), p. 166. At least 8,000 of the 24,000 overseas affiliates of U.S. firms made use of the parent firm's processes and patents—p. 163.

[3] E. Mansfield and A. Romeo, "Technology Transfer to Overseas Subsidiaries by U.S.-Based Firms," *Quarterly Journal of Economics*, vol. 95, No. 4, December 1980, p. 739. Also E. Mansfield, "Market Structure, International Technology Transfer, and the Effects on Productivity of the Composition of R and D Expenditures," final report to the National Science Foundation, 1981, p. 51. The proportion of technologies less than 5 years old (as measured by the time since first utilization in the United States) transferred to subsidiaries in developed countries increased from 27 percent for the period 1960-68 to 75 percent for 1969-78 (although no such trend emerged for technologies transferred to subsidiaries in LDCs or through unaffiliated licenses and joint ventures). Mansfield found that technologies transferred to affiliates in developed countries were much newer on the average (with a time lag since utilization in the United States of 5.8 years) than those transferred to subsidiaries in developing countries (9.8 years).

TECHNOLOGICAL ADVANTAGE AND NATIONAL STRATEGY

Has the ability of U.S. firms to compete in technologically based products really declined? There is no smoking gun. Yet a body of evidence with impressive cumulative impact supports such a conclusion. This section examines a range of indicators bearing on U.S. technology, before going on to comparisons with Japan and other nations.

R&D and Technology Development in the United States

Although resource inputs to technology development increased over the 1970s and into the 1980s, outputs decreased on several measures. Figure 39 shows that R&D spending by American companies has grown steadily in real terms, with the exception of recessionary periods in 1971-72 and 1975. Expenditures grew by more than 80 percent in real terms over the period 1975-1985 (reaching an estimated $22.6 billion in 1972 dollars, coresponding to $52.4 billion in 1985 dollars). The number of engineers and scientists engaged in R&D has increased from about 500,000 in the middle 1960s to more than 750,000 currently (a period during which R&D engineers and scientists in Japan tripled, as noted below).

Many more engineers and scientists graduated from American universities during the cyclical upswing of the 1980s than during the previous decade. Although undergraduate engineering enrollments turned back down in 1984, bachelor's and master's degrees in engineering reached record highs during the first half of the 1980s—of particular significance given that engineers and scientists play quite different roles in technology development (transfers of skills across the boundary between science and engineering can be far more difficult than the layperson might imagine). After rapid growth during the 1960s, the number of doctoral degrees in science and engineering peaked in the early 1970s and began to slowly decline. The drop would have been more rapid—and its consequences more serious—without an influx of foreign students, particularly dramatic at the doctoral level in engineering (table 24). Although comprising only 2.7 percent of the total student population, foreign students received 42 percent of all engineering doctorates in 1983.[4]

Many of these foreign graduates remain in the United States and find jobs with American corporations. In 1984, for example, 87 percent of foreign doctoral recipients with permanent visas and 49 percent of those with temporary visas chose this option.[5] Because they can seldom get security clearances without citizenship, more foreign-born technical graduates find their way into American companies that emphasize commercial rather than defense-related lines of business. (About 20 percent of the Nation's engineers work in defense industries.[6]) In fact, American industry has come increasingly to rely on foreign nationals to fill technical jobs. The proportion of the U.S. engineering work force made up of naturalized citizens grew from about 5 percent in 1972 to 15 percent a decade later. Many high-technology companies in such industries as semiconductors and computer software depend heavily on foreign-born engineers, some of whom have themselves started entrepreneurial firms; Tandon Corp., founded by Sirjang Tandon in

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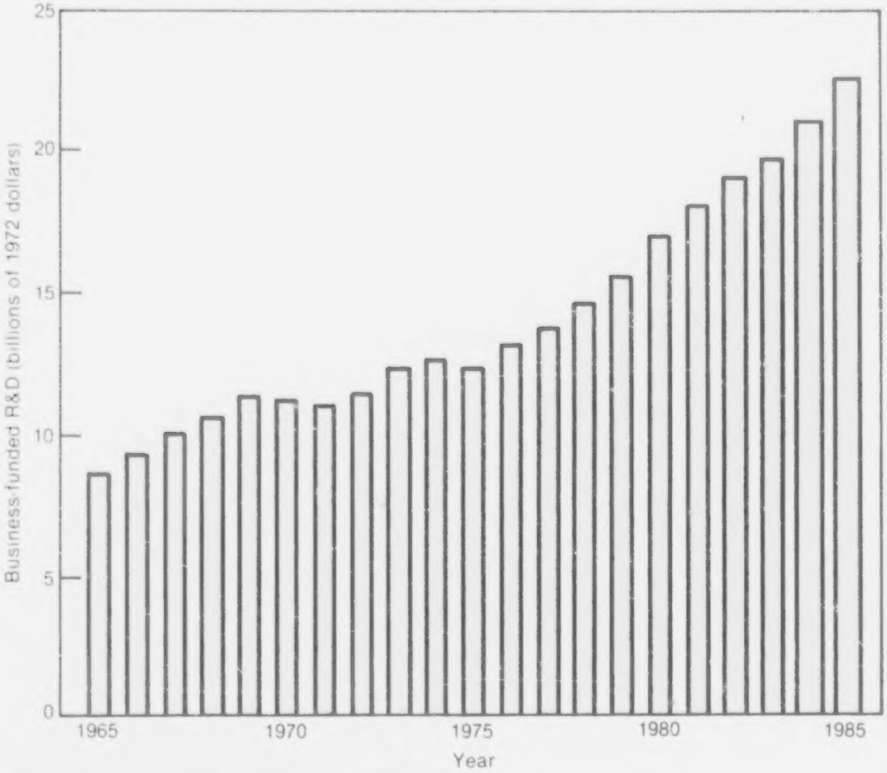
[4] More foreign students enroll each year in American universities (over 300,000) than in those of France (110,000), the United Kingdom (60,000), West Germany (50,000), and Canada (40,000) combined—S. Kahne, "Does the U.S. Need a National Policy on Foreign Students?" *Engineering Education*, October 1983, p. 54. The greatest numbers of foreign nationals in American universities come from Taiwan (22,600 in 1984-85), followed by Malaysia (21,700), Nigeria (18,400), and Iran and South Korea (both about 16,500). See *Trade in Services: Exports and Foreign Revenues* (Washington, DC: Office of Technology Assessment, September 1986), p. 64.

[5] "Foreign Citizens in U.S. Science and Engineering: History, Status and Outlook," National Science Foundation, Division of Science Resources Studies, Washington, DC, January 1985, pp. 168-169.

[6] At the B.S. level, the 1984 figure for all engineers was 19.9 percent, ranging from 59.8 percent for aerospace engineers down to 16 percent for materials specialists. About 20 percent of B.S. level computer scientists, and 40 percent of mathematics majors were working on Defense Department projects in 1984. The percentages have generally declined somewhat since the Vietnam War period, and are broadly similar among engineers with graduate degrees. See *The Impact of Defense Spending on Nondefense Engineering Labor Markets* (Washington, DC: National Academy Press, 1986), p. 74.

Figure 39.—Constant-Dollar Growth in R&D Spending by American Companies



NOTE: 1983 preliminary, 1984 and 1985 estimated.

SOURCE: *Science Indicators 1985* (Washington, DC: National Science Board, 1985), p. 252.

1975 to make disk drives for computers, is one of the better known examples.[7]

While resource inputs to U.S. technology development show substantial increases in over the past 10 to 15 years, this growth has been neither so rapid nor so consistent as in other major industrial nations (as summarized below).

Table 24.—Foreign Nationals Receiving Doctoral Degrees in Engineering and Science From American Universities

	Foreign nationals on temporary visas as a percentage of all doctoral recipients in engineering and science				
Field	1966	1970	1974	1980	1983
Engineering	16.7%	13.7%	22.4%	34.3%	42.1%
Physics and astronomy	12.2	11.3	17.2	19.2	24.6
Chemistry	11.1	7.9	10.2	15.4	16.1
Mathematics	12.6	10.9	18.5	18.7	29.8
Total[a]	15.3%	12.5%	16.7%	18.8%	15.5%

[a] Includes the following fields not separately tabulated: biological, earth, environmental, agricultural, and medical sciences; economics; political science.

SOURCE: *Demographic Trends and the Scientific and Engineering Work Force—A Technical Memorandum* (Washington, DC: Office of Technology Assessment, December 1985), p. 44.

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[7] On Tandon, see C.L. Howe, "Floppy Fortunes Founder," *Datamation*, Nov. 1, 1985, p. 60.

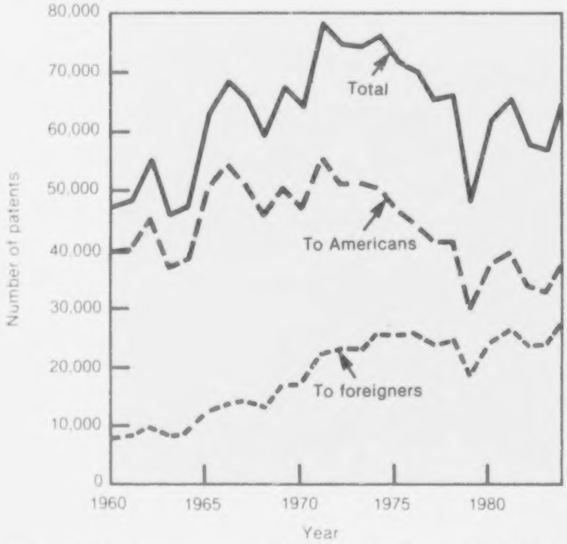
In many chemical, electronics, and computer firms, the proportion of foreign-born technical employees has risen to a quarter or more—"Survey of 300 U.S. Firms Finds One-Half Employ Foreign Scientists and Engineers," NSF 85-336, National Science Foundation, Division of Science Resources Studies, Science Resources Studies Highlights, Washington, DC, Feb. 28, 1986, p. 1.

Moreover, expansion in U.S. R&D has come to depend on the willingness of foreign-born students to emigrate to this country. (American-educated engineers from South Korea and Taiwan often return home in mid-career, becoming highly productive employees of firms that compete with U.S.-based enterprises.) Finally, resources devoted to commercial technology development have not grown as rapidly as those going to defense-related R&D, which attracts many of the Nation's best technical people.

If such observations seem troubling, the data on outputs of the R&D process are more so. Although R&D outputs are much harder to measure than inputs, patents and other indicators offer proxies. Figure 40 shows that patenting in the United States by Americans has steadily declined from a peak in 1970. In contrast, U.S. patents granted to foreign parties have continued to rise.

Given the greater expenditures on R&D noted above, why should the rate of patenting by American corporations slow? (Companies, rather than individuals, file for most patents.) Two possibilities exist: declining productivity of the R&D process in the United States, and/or conscious choices by American companies *not* to seek patent protection. Taking the second possibility first, a recent survey of U.S. firms found more reporting an increase than a decrease in the *percentage* of developments they chose to patent.[8] All else the same, this finding of a greater propensity to patent, coupled with the drop in total patents granted, suggests that the number of patentable inventions resulting from U.S. industrial R&D has fallen. Further evidence pointing in the same direction comes from a decline in research publications by industrial employees. The number of such publications fell from 12,200 in 1973 to 10,400 in 1980, with most of the drop occurring between 1973 and 1977.[9] In sum, there is good, although not conclusive, evidence that, despite growing investment in commercial technology development in the United States, the flow of new technologies from that effort has declined.

Figure 40.—U.S. Patents Granted, by Nationality of Inventor



NOTE 1979 data are spuriously low due to lack of funds in the Patent Office for printing and issuing patents.

SOURCE *Science Indicators 1985* (Washington, DC: National Science Board, 1985), p. 258.

Foreign Technology Development

Europe and Japan

Certainly, technology development in the United States has not matched the surge abroad. Since the end of World War II, Europe and Japan have rebuilt their technological infrastructures and manufacturing capacities to the point that many companies now operate at the state-of-the-art in many technologies. As previous OTA studies have indicated, lagging international competitiveness among European firms can seldom be attributed to disadvantages in technology; the sources of competitive difficulty typically lie elsewhere, often in the translation of technology into viable commercial products.[10] Japan, in some contrast, has applied

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[8] E. Mansfield, "Studies of Tax Policy, Innovation, and Patents: A Final Report," Final Report to the National Science Foundation, October 1985, p. 86. The survey covered patenting decisions over the periods 1965-69 and 1980-82 in 100 U.S. firms.

[9] The figures include all articles with at least one author from private industry in over 2,100 journals included in the *Science Citation Index* of the Institute for Scientific Information. See *Science Indicators 1982* (Washington, DC: National Science Board, 1983), p. 296.

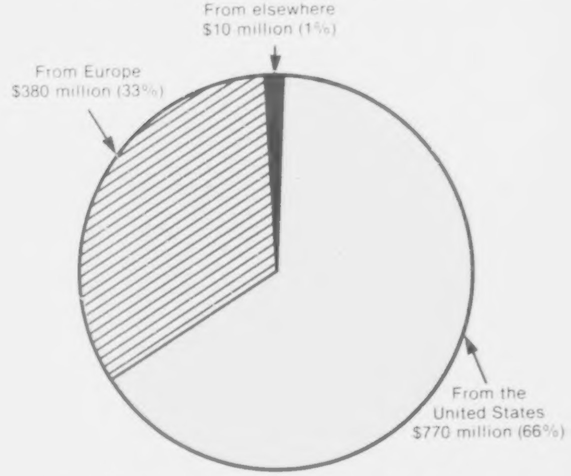
[10] See, e.g., *International Competitiveness in Electronics* (Washington, DC: Office of Technology Assessment, November 1983), chs. 4, 5, and 10.

Table 25.—Technical Licensing Transactions of Selected European Countries

	Balance of payments position in fees and royalties (millions of 1975 U.S. dollars)					
	1972			1982		
	Receipts	Payments	Balance	Receipts	Payments	Balance
United Kingdom	$561	$508	$+53	$608	$496	$+147
France	301	459	−153	550	641	− 91
Federal Republic of Germany	269	627	−358	340	675	−335
Netherlands	151	222	− 71	209	351	−142
Italy	81	470	−389	133	496	−363

SOURCE: *OECD Science and Technology Indicators II: Resources Devoted to R&D, Technological Performance and Industrial Competitiveness* (Paris: Organization for Economic Cooperation and Development, 1985), p. 69.

Figure 41.—Japan's Technology Imports, 1982



Total: 6,936 licensing agreements valued at $1.16 billion

SOURCE: *Report on the Survey of Research and Development* (Tokyo: Prime Minister's Office, Statistics Bureau, 1983), p. 44.

technology very effectively during its rise as an industrial power.

Both Europe and Japan have imported technical know-how from the United States, as figure 38 suggested. In Europe, inputs of American technology accompanied heavy direct investment by American firms beginning in the 1950s. Europe's technology imports continued to increase, but more rapid growth in outward licensing shows that European countries have become important sources for new technology as well. Even so, as table 25 indicates, only the United Kingdom has been a net exporter of technology. (Indeed, a bare handful of nations run a surplus in licensing transactions.)

In Japan, where government policies prevented most direct investment by American companies, the technology transfer channels differed (box V). About two-thirds of Japan's licensing payments continue to go to U.S. firms, with most of the remainder to European companies (figure 41). In Europe, affiliates of American companies account for the lion's share of U.S. licensing revenues (table 26); in contrast, arms-length transactions—those with unaffiliated firms—have predominated in Japan. Finally, while Japan's *total* licensing payments still exceed receipts (table 27)—reflecting old licenses—*new* outward licensing by Japanese companies has exceeded inward licensing since 1973 (much of this associated with FDI by Japanese companies elsewhere in Asia).

What of R&D spending in other nations? Over the period 1969-81, real R&D spending by business and industry (rather than government) in the United States grew at 4.1 percent per year, less than half the rate (8.6 percent) in Japan.[11] Today, business and industry in Japan spend more on R&D than in any other country except the United States—table 28. While the rate of growth of business spending on R&D in current dollars has been slightly greater over the

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[11] *OECD Science and Technology Indicators II: Resources Devoted to R&D, Technological Performance and Industrial Competitiveness: Annex* (Paris: Organization for Economic Cooperation and Development, 1985), table 4. Over the 1969-81 period, the real annual rates of growth in business-funded R&D averaged 5.4 percent in West Germany, 5.5 percent in France, but only 2.0 percent in Britain. The figure for the European Economic Community as a whole comes to 4.5 percent, and for the Organization for Economic Cooperation and Development, 5.0 percent.

Box V.—Have U.S. Firms Licensed Their Technology Too Cheaply?

American technology helped fuel postwar economic growth in both Europe and Japan. In Europe, American technology accompanied American investment, but the Japanese Government followed a strategy of restricting direct investment. With government policies also limiting goods imports, and Japanese companies aggressively seeking foreign know-how, American companies supplied Japan with a great deal of technology under arms-length licensing agreements. Only in the late 1960s did Japan begin opening its economy to foreign investment and imports; after 1967, majority foreign ownership in new Japanese companies was permitted in some industries, with entry into others liberalized later. As table 26 indicates, U.S. companies continue to receive substantially more in royalties and license fees from unaffiliated firms than from affiliates in Japan. In contrast, affiliates account for 80 percent of payments from Europe.

Between 1950 and 1980, Japanese firms entered into more than 30,000 technology transfer agreements with American companies, for which they paid an estimated cumulative total of $10 billion.[1] With remarkable speed, Japanese companies moved from commodity goods and simple consumer products to high-technology manufactures, including computers and integrated circuits that often match or exceed the best products of American firms. Today, many Japanese companies continue to pay royalties on technologies they have long since adapted and improved upon.

Hence the claim that, into the 1970s, American companies sold technology to Japan too cheaply. The implication is that an appropriate price for a given package of technology exists, and that, for one reason or another, bargaining processes between U.S. firms and potential licensees in Japan failed to identify it. In essence, the underpricing argument suggests that U.S. companies took an overly simple approach to licensing decisions—that they considered their technology development expenses as sunk costs, with licensing revenues desirable as extra returns. Because they underestimated the ability of Japanese manufacturers to challenge them in the U.S. market and in third countries, American companies accepted royalty rates that were too low.

As this suggests, the question of possible underpricing of technology can be discussed on several levels. Normally, an American firm with proprietary technology will assess the possibilities for exploiting its know-how internationally, with an eye to maximizing profits. In Japan, government restrictions barred both U.S. exports and FDI. Given these constraints, licensing might seem the best—indeed only—choice, on the basis that some return from the Japanese market is better than none. But what of the royalty to be charged? How should it be set? From the licensor's point of view, almost any royalty rate might be acceptable, since the R&D had already been paid for. But plainly, such a calculation depends on the absence of future competition based on the transferred technologies. If American managers had foreseen that Japanese manufacturers would enter U.S. markets, and compete with them for export sales in third countries, they should have demanded higher royalties. In the extreme, they might have refused to license at all.

In any case, Japanese companies learned very quickly to innovate on their own; the stream of new products in consumer industries beginning during the early 1960s shows this quite convincingly, as does the unquestioned technical competence of Japanese firms in industries like iron and steel production.[2] Help from American companies was useful but seldom essential, and, in later years, only rarely went beyond that available from Europe. If licensing saved the Japanese time and money, American firms benefited from revenues that they could invest in their own operations—earnings that, for U.S. industry as a whole, have approached $1 billion annually in recent years (table 26). Finally, even with hindsight, the consequences of particular licensing arrangements often remain ambiguous. In 1960, when Japan's Government permitted IBM to begin local production of computers, the price included licenses for Japanese companies. IBM-Japan quickly gained the lead in the Japanese computer market; although overtaken in sales during the first half of the 1980s by Fujitsu and NEC, IBM still has the largest installed equipment base in Japan. Both the Japanese companies benefited to at least a modest extent from IBM's licensing. But if IBM had not granted these licenses, the company probably would not have been permitted full-scale entry into Japan's computer market until the liberalization of the 1970s, by which time its rivals' installed bases would have presented a severe obstacle to market penetration.[3]

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[1] J. Abegglen, "U.S.-Japan Technological Exchange in Retrospect, 1946-1981," *Technological Exchange: The U.S.-Japanese Experience*, C. Uyehara (ed.) (Washington, DC: University Press of America, 1982), p. 1

[2] For one of the most fully documented recent accounts, focusing on manufacturing technology as well as product development, see M.A. Cusumano, *The Japanese Automobile Industry: Technology and Management at Nissan and Toyota* (Cambridge, MA: Harvard University Press, 1985).

Today, most American firms would claim to take considerable care in negotiating license agreements to prevent future damage to their own interests—and more care today than in earlier years. Where once they licensed their microprocessor designs to Japanese firms, American manufacturers—who remain well ahead in this technology—now refuse to do so.[4] In OTA's interviews, American managers expressed a clear sense of the strategic risks involved in licensing in Japan (or to newly industrializing countries, particularly in the Far East). But their evaluations—whether of isolated arms-length agreements, or of complex strategic options in which licensing is one part of a carefully designed thrust into overseas markets—will be couched in terms of their own interests, and to a lesser degree those of their industry, their suppliers, their customers. The bigger picture of U.S. competitiveness will more than likely remain outside their calculations.

When it comes to tightly written licensing agreements recent shifts in antitrust enforcement by the Federal Government make things easier for American companies. Managers express considerably less concern than half a dozen years ago over possible antitrust litigation, given that the Department of Justice has sent enough signals to convince even the more conservative corporate legal advisers that restrictive licensing provisions, once subject to challenge as anti-competitive, will be viewed more tolerantly in the future (see the section on "Policy Issues" later in the chapter). Companies now feel free to negotiate agreements barring their licensees from a wider range of activities that might pose direct competitive challenges.

In the end, the original question—whether U.S. firms licensed their technology too cheaply—seems less significant than the question of how the United States can begin to learn more effectively from Japanese technology. Regardless of the extent to which Western technologies helped Japan reach early technical maturity, the fact is that in the future the United States will have to depend as heavily on Japanese technology as Japan depends on the United States. U.S. licensing payments to Japanese companies have been steadily increasing, with about a fifth of all U.S. payments now going to Japan. Rather than seeking to stem technology outflows, U.S. policymakers might make equal access to foreign technology a negotiating objective in trade talks, fund fellowships for American students in engineering and science to work in Japanese laboratories, and seek exchanges of U.S. industrial R&D personnel with those of Japan (and other countries). (Ch. 10 includes specific policy options.) Direct participation by Americans in overseas industrial R&D will speed U.S. access; people transfer technology much more effectively than documents. It is time for Americans to go overseas in search of technology as frequently as foreigners come here.

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[3] *International Competitiveness in Electronics* (Washington, DC: Office of Technology Assessment, November 1983), p. 154.

[4] This refusal is one reason for a new agreement between Fujitsu and Hitachi to jointly develop a family of 32-bit microprocessor designs. See S.K. Yoder, "Hitachi, Fujitsu Link in Microprocessors," *Wall Street Journal*, Oct. 28, 1986, p. 39

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past 5 years in the United States, if adjusted for inflation, growth would be considerably more rapid in Japan. Furthermore, the overall lead of the United States stems from nothing more than the greater size of the U.S. economy.

In Japan, industry now accounts for more than three-quarters of all R&D spending, compared with about half here, while business-funded R&D as a percentage of gross domestic product (GDP) is much higher in Japan. As indicated in table 1 (ch. 1), business and industry in Japan spent (a projected) 2.14 percent of GDP on R&D in 1986, compared with 1.42 percent in the United States. As table 1 also showed, in the early 1970s, this ratio did not differ greatly among the United States, Japan, and West Germany. Around the middle of the dec-

Table 26.—U.S. Technical Licensing With Europe and Japan (millions of current dollars)

	Affiliated	Unaffiliated	Total
U.S. receipts of royalties and license fees from Western European companies:			
1978	$1,482	$448	$1,930
1980	2,019	476	2,495
1983	2,355	628	2,983
1984	2,467	604	3,071
1985	2,657	634	3,321
U.S. receipts of royalties and license fees from Japanese companies:			
1978	$273	$399	$ 612
1980	—[a]	347	NA
1983	392	523	915
1984	449	549	998
1985	476	576	1,052

NA — Not available

[a] Data suppressed by Department of Commerce to preserve confidentiality

NOTE: 1983-85 data are not directly comparable with that for earlier years because of a new benchmark survey and the inclusion of non-manufacturing royalties and fees beginning in 1983

SOURCES: **1978, 1980**: Department of Commerce, Bureau of Economic Analysis, unpublished statistics; **1983-85**: R.L. Krueger, "U.S. International Transactions, First Quarter 1986," *Survey of Current Business*, June 1986, pp. 64-65

ade, however, both Japanese and German companies began increasing their R&D spending at higher rates. The increase in Japan since 1980 has been especially dramatic. Everything else the same, the figures in table 1 demonstrate that Japanese and also West German companies have placed substantially higher priorities on R&D than their American counterparts; *the very high rates of R&D spending by Japanese companies over the past 3 years demonstrate their intent to move even more rapidly into high technology.*

Trends in employment of R&D engineers and scientists paint a similar picture. Since 1965, the number of engineers and scientists has increased steadily in the United States, as well as in Japan and in West Germany, Britain, and France. In 1981, the last year for which data are available for all five countries, the United States employed more R&D personnel than Japan and the three major European economies combined.[12] While impressive, this represents a much smaller differential than existed in 1965, when about twice as many people worked in R&D in the United States as in the other five countries. Indeed, the number of R&D personnel in the United States actually declined during the early 1970s. U.S. R&D employment passed its earlier peak by 1977, but none of the other countries passed through such a slump.

One further input measure stands out as having grave implications for the future: the number of engineering graduates. Japanese universities have been awarding more engineering degrees at the bachelor's level than have American schools—74,000 in 1982 compared with 67,000 here.[13] Six engineers graduate in Japan for every scientist; in the United States, 1.4 science majors graduate for every engineer. Although engineers and scientists share many

Table 27.—Japan's International Technical Licensing

	Outward licensing			Inward licensing			Net receipts	
		Value			Value		Value	
	Number of agreements	(Billions of yen)	(Millions of dollars)	Number of agreements	(Billions of yen)	(Millions of dollars)	(Billions of yen)	(Millions of dollars)
All Japanese technology exchange agreements in force:								
1978	3,157	122.0	$620	6,573	192.1	$ 985	−70.1	$−359
1980	4,103	159.6	786	7,248	239.5	1179	−79.9	−394
1982	4,738	184.9	760	6,936	282.6	1162	−79.7	−402
New Japanese technology exchange contracts:								
1978	1,063	47.1	$242	936	38.2	$ 196	8.9	$ 46
1980	1,237	74.3	366	919	27.7	136	46.6	230
1982	1,970	63.3	260	929	44.4	183	18.9	78

SOURCE: *Report on the Survey of Research and Development* (Tokyo: Prime Minister's Office, Statistics Bureau, 1983), p. 42

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[12] *Science Indicators, The 1985 Report* (Washington, DC: National Science Board, 1985), p. 186. The 1981 figures are: United States, 691,000; Japan, 318,000; Germany, 128,000; Britain, 96,000; France, 85,000. By 1983, the U.S. figure was 750,000, and that in Japan, 342,000.

[13] *Science Indicators: The 1985 Report*, op. cit., p. 6. The number of engineering bachelor's degrees awarded in Japan has grown steadily from 10,000 in 1955—L.S. Hiraoka, "Japan's Technology Trade," *Technological Forecasting and Social Change*, vol. 29, 1985, p. 237. For the data on engineering graduates compared to science majors, below, see *International Science and Technology Data Update 1986*, NSF 86-307 (Washington, DC: National Science Foundation, 1986), p. 28.

Table 28.—R&D Funded by Business and Industry

	Business-funded R&D expenditures (billions of current dollars, yen, or deutsche marks and percentage of total national R&D spending)				Average annual rate of growth, 1981-86 (percent)
	1981	1983	1985	1986[a]	
United States:					
Billions of dollars	$35.9	$43.2	$53.2	$58.2	10.1%
As percentage of all U.S. R&D	50.0%	50.0%	49.9%	49.8%	
Japan:					
Billions of yen	4,364	5,451	6,500	7,000	9.9%
Billions of dollars[b]	$19.8	$23.0	$27.5	$42.9	
As percentage of all Japanese R&D	72.9%	75.9%	77.4%	77.8%	
Federal Republic of Germany:					
Billions of deutsche marks	22.5	26.0	30.0	32.5	7.6%
Billions of dollars[b]	$10.0	$10.2	$10.3	$14.9	
As percentage of all West German R&D	54.9%	56.6%	57.6%	58.8%	

[a] Projected

[b] Conversions to dollars for year in question from *Economic Report of the President* (Washington, DC: U.S. Government Printing Office, February 1986), p. 373, except for 1986, where mid-year values have been used.

SOURCE: "FRG Institute Compares German, U.S., Japan Research Expenditures," *Europe Report—Science and Technology*, Joint Publications Research Service JPRS-EST-86-033, Nov. 6, 1986, pp. 25, 28, 31. Translated from *Technologie Nachrichten*, May 15, 1986. Original source: Battelle Institute, Frankfort.

skills, product/process design and development—the heart of an industrial R&D operation—is work for which engineers are trained and scientists are not. The quality of engineering education in Japan is distinctly inferior to that in the United States, but in numbers—given that Japan has, for more than a decade, been graduating twice as many engineers per capita—it would be hard to fault that country's performance.[14]

What have been the impacts of increased inputs to the R&D process in other countries? Patent applications have fallen in the major European nations (table 29), just as they have in the United States. The implication, again as here: declining technological productivity. The case is different for Japan, where companies seem to have a much higher propensity to patent (in part because patents are awarded on a first-to-file basis, rather than first-to-invent). This makes international comparisons of patenting problematic. Even so, the steep rise in domestic patent applications in Japan—they have more than doubled since 1970, while patenting in other countries has declined—probably indicates a significant increase in the output of Japanese R&D.

Because patents are only valid in the country granting them, a company seeking to protect its technology must obtain patents everywhere it seeks either to use an invention or to prevent competitors from doing so. Therefore, external patenting—filings by residents of one country in another—become another possible measure of R&D proficiency. Securing adequate protection can be expensive, particularly where multiple patents must be sought to lock up a new development. Because company managements approach such decisions with care, data on external patents provide a useful indicator of the commercial value businesses place on their technical innovations. These data—table 30—show that American companies file the greatest number of external applications. But the figures also show that the number of U.S. applications fell sharply during the 1970s, before recovering in recent years.

The pattern is similar for Western Europe, but not Japan, where companies have filed

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[14] Major Japanese corporations have been forced to develop extensive internal training programs to compensate for the shortcomings of Japan's engineering schools. See *International Competitiveness in Electronics*, op. cit., pp. 314-317.

Other countries graduate engineers in much smaller numbers than Japan or the United States.

Table 29.—Patent Applications by Domestic Residents (thousands)[a]

	1950	1960	1970	1975	1980	1981	1982	1983
United States	57.4	63.1	76.2	64.4	62.1	62.4	63.3	59.4
Japan	14.5	31.9	100.5	135.1	165.7	191.6	210.9	227.7
Federal Republic of Germany	31.8	36.5	32.8	30.2	30.6	30.3	31.1	32.1
France	16.2	14.5	14.1	12.1	11.1	11.1	10.8	11.2
United Kingdom	21.0	22.8	25.2	20.8	19.7	20.9	20.6	20.0
Total[b]	178.0	200.6	287.7	299.6	309.3	329.6	350.5	364.5

[a] This table is based on adjusted statistics originally compiled by the World Intellectual Property Organization (WIPO) from reports of national patent offices. The introduction of the European Patent Convention (EPC) system in 1978 and, to a lesser extent, the Patent Cooperation Treaty (PCT) system in 1970, has made it easier for companies to obtain patent [illegible] in multiple countries. Under the EPC, a firm can file a single application covering some or all of the (European) member nations. As companies switched to the EPC system, patenting in the national offices of some of the member countries declined. To correct for this effect, the WIPO statistics have been augmented by EPC "designation" and PCT data for years after 1978. This adjustment raises external patenting levels for the post-1978 period significantly above the unadjusted levels published in *Science Indicators*.

[b] Includes Belgium, Switzerland, Australia, Yugoslavia, Denmark, Norway, Greece, Finland, Portugal, New Zealand, Ireland and Iceland, as well as the countries listed separately.

SOURCE: *OECD Science and Technology Indicators II: Resources Devoted to R&D, Technological Performance and Industrial Competitiveness: Annex* (Paris: Organization for Economic Cooperation and Development, 1985), table 24.

Table 30.—External Patent Applications by Nationality of Applicant (thousands)[a]

	1950	1960	1970	1975	1980	1981	1982
United States	34.5	74.1	123.7	93.0	116.3	127.0	123.2
Japan	—[b]	3.0	26.6	27.7	45.5	49.3	56.4
Federal Republic of Germany	13.3	47.3	70.1	60.8	82.6	82.6	79.5
France	11.6	16.2	24.4	23.4	33.0	31.4	34.7
United Kingdom	20.5	29.1	33.5	24.4	28.1	31.2	33.2

NA = Not Available.

[a] Filings in countries other than that in which the applicant resides. Adjusted statistics, as explained in table 29, footnote a.

[b] Negligible.

SOURCE: *OECD Science and Technology Indicators II: Resources Devoted to R&D, Technological Performance and Industrial Competitiveness: Annex* (Paris: Organization for Economic Cooperation and Development, 1985), table 24.

steadily increasing numbers of external applications. (The establishment of the European Patent Convention in 1978 made patenting across countries in Europe easier, bringing a sharp rise in external patenting. Under the new system, a firm can file a single application that covers some or all of the European member countries.) For the United States, the data in table 30 are rather more encouraging than other indicators, in that they suggest strong and continuing commitment to international business by American firms. Yet the data also show a marked increase in external patenting by Japanese firms; more recent figures, if available, might well show that Japan has now surpassed West Germany in external patenting.

Newly Industrializing Asian Countries

Japan, the first industrial power to emerge in the Far East, has been followed by South Korea, Taiwan, Singapore, and Hong Kong. While each has pursued its own developmental path, all have been somewhat akin to Japan in first concentrating on apparel and other labor-intensive goods before branching into more capital- and skill-intensive industries. Today, some of these countries, notably South Korea, manufacture integrated circuits not far behind the state-of-the-art and enjoy expanding shares of the U.S. market for automobiles, personal computers, and a variety of computer peripherals. Moreover, as noted in chapter 4, Korean engineering and construction teams went into the Middle East more than a decade ago, winning contracts from European and American firms. In Taiwan as well as Korea, the government has stepped up support for education and training of technicians, engineers, and scientists.

Like Japan, the newly industrializing countries (NICs) in Asia have licensed technology from American companies (table 31). But, while U.S. receipts for royalties and license fees from

Table 31.—U.S. Technical Licensing With Newly Industrializing Asian Countries[a]

	U.S. receipts of royalties and license fees (millions of current dollars)		
	Affiliated	Unaffiliated	Total
1978	$ 39	$ 70	$109
1980	66	103	169
1982	67	166	233
1983	99	190	289
1984	121	203	324
1985	115	218	333

[a] BEA's categories "developing countries, other" for 1978-82 and "other countries in Asia and Africa" for 1983-85, both of which exclude Latin America and therefore reflect primarily licensing with Asian NICs. Licenses in manufacturing only for 1978-82, all industries for 1983-85.

SOURCES: **1978-82**: Department of Commerce, Bureau of Economic Analysis, unpublished statistics, January 1986 (Table 6C: U.S. Receipts of Royalties and Licensing Fees in Manufacturing by Area). **1983-85**: R.C. Krueger, "U.S. International Transactions, First Quarter 1986," *Survey of Current Business*, June 1986, p. 66.

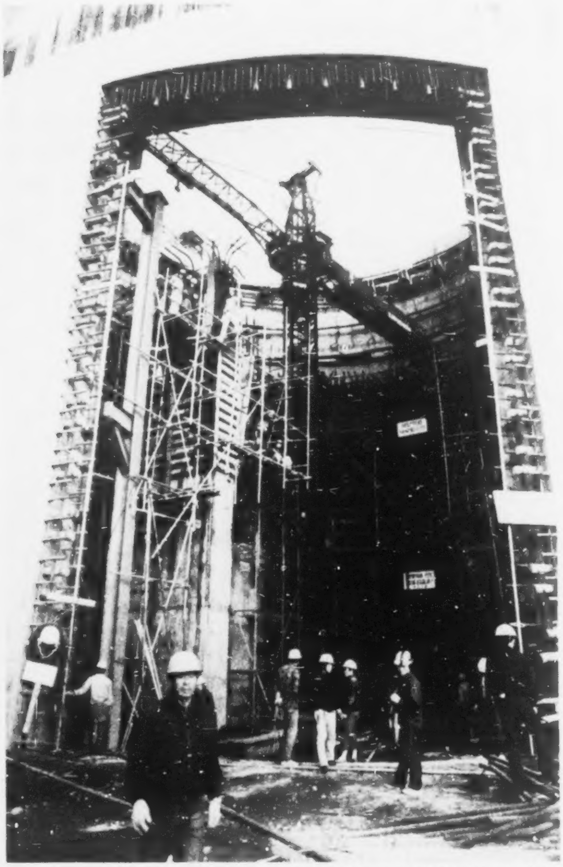

Photo credit: Bechtel Power Corp.

Cooling tower for nuclear powerplant under construction in South Korea.

the Asian NICs have been growing at a high rate, they still account for no more than 7 percent of the U.S. total. Japan has also been a major source of technology for the rest of Asia, with many licensing deals involving affiliates of Japanese companies. At the same time, Japanese firms have been notoriously reluctant to license technology to independent firms in countries like South Korea that are seen as potential rivals.[15] One of the best-known cases has been the adamant refusal by Japanese firms to license video-cassette recorder technologies to Korea. The Koreans developed their own. Japanese steelmakers also raised strong objections to licensing technology for the expansion of South Korea's steel industry. While both South Korea and Taiwan have set out on a path in electronics much like that Japan followed—first consumer products like TVs, then semiconductors and computer equipment—Hong Kong and Singapore have put relatively more emphasis on software.

The unanswered question is whether or not the Asian NICs will continue to expand their indigenous technological capabilities at a rate that would eventually challenge other industrial nations. To do so, the NICs would have to overcome the limitations imposed by small domestic markets, along with growing trade friction and import barriers in countries to which they sell. None of the NICs has been able to strengthen its science and technology infrastructure as rapidly as Japan did during the 1960s; although technical people have been returning to South Korea and Taiwan from overseas in mid-career, all the NICs remain short of engineers and scientists. They spend far less on R&D than the advanced nations. Both domestic and external patenting levels remain low.[16] For all these reasons, sustained *technological* challenges from the NICs appear to be a long way off. At the same time, these countries have a sound base in a wide range of relatively standardized technologies already, and seem bound to continue doing well with relatively routine products in quite a wide range of industries. Perhaps their greatest future handicap will simply be that they must compete with Japan.

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[15] M. Schrage, "(Korean) Electronics Industry Seeks Leading Edge," *The Washington Post*, Feb. 9, 1986, p. F1. Also, M.C. Harris, "Japan's International Technology Transfers," paper prepared for presentation at Southeast Region Japan Seminar, Apr. 20, 1985, p. 15.

Still, Japan accounted for 55 percent of more than 3,000 licenses arranged by Korean companies between 1960 and 1984—B. Wysocki, Jr., "Weak in Technology, South Korea Seeks Help From Overseas," *Wall Street Journal*, Jan. 7, 1986, p. 1.

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[16] *1982 Statistical Yearbook* (New York: United Nations, 1985), table 72. Patenting by residents of the four Asian NICs probably represents less than 1 percent of all foreign-origin U.S. patents —"All Technologies Report, 1985," Department of Commerce, Patent and Trademark Office, Washington, DC, p. A2.

LICENSING STRATEGIES

Integration

Increasingly, American companies view technical licensing as an integral part of their business strategies. Licensing has always been an alternative for exploiting proprietary technology internationally. But most companies would choose when possible to maintain a tight hold over their technical know-how by using it to produce for export, or transferring it to controlled subsidiaries abroad. Today, these choices may be less practical than in years past. When circumstances foreclose possibilities for exports or foreign investment, companies stand to recoup at least some of their development costs through licensing. The firm may be able to earn an incremental return in markets that it otherwise could not enter at all—for reasons ranging from its own resource limitations to foreign government barriers. The situations that follow are typical:

1. If trade barriers, small market size, or management's lack of familiarity with overseas markets foreclose exporting from the United States, licensing a foreign company to make and sell products can provide a means of testing the foreign market for later investment. Caterpillar Tractor, for example, often used technical licensing as a precursor to eventual expansion abroad.
2. Small companies typically face constraints on overseas operations stemming both from financial requirements and limited managerial experience. Even when they can afford to invest abroad, many smaller American firms report that they can't find the management talent to expand. Probably for this reason, smaller companies are more likely to license than larger, integrated firms with a broad range of internal resources to draw on. In interviews, several executives from small, fast-growing computer firms cited managerial overload as a primary reason for weighing foreign involvements carefully.
3. Foreign governments may combine import barriers with investment restrictions (including performance requirements that require high fractions of local value added, local hiring, or re-exporting), forcing companies to seek alternatives.[17] As pointed out above, Japan barred foreign investment during the earlier postwar period, while the Ministry of International Trade and Industry (MITI) carefully monitored inward licensing. Today, a number of Asian and Latin American nations emulate this approach.
4. The U.S. Internal Revenue Service requires that MNCs allocate R&D expenditures between parent company and subsidiaries. Managements sometimes choose to formalize this requirement through licenses, even though no operational need exists.

This list covers only a few examples from the wide variety of circumstances that can lead companies to choose licensing as a way of doing business abroad. Generally speaking, foreign market uncertainties, which raise the risks of direct investment, make licensing more attractive to managements. Such uncertainties can have many sources: erratic government policies, foreign exchange volatility, lack of information and experience.

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[17] On foreign government policies and laws covering licensing, see J.D. Frame, "Political Risk in International Technology Transfer," *Journal of Technology Transfer*, vol. 10, 1986, p. 5.

The appeal of licensing also depends on the nature of the technology in question. Most firms shy away from licensing their core technologies—those on which their primary lines of business depend—to unaffiliated foreign firms. Licensing always carries risks of disclosing knowledge to unauthorized parties; sometimes the licensee attempts to evade restrictions in the contract, perhaps using the technology surreptitiously. Because policing agreements is always a problem, managements seldom take chances with critical know-how. On the other hand, a firm that occupies a long-established competitive niche may well trade even state-of-the-art technologies with others that specialize. Or, a smaller company in a fast-moving industry may simply be unable to exploit every opportunity that comes along. Both factors are at work in industries like pharmaceuticals, where international licensing between competing firms has been common.

Box W amplifies on the circumstances under which American firms license overseas. In most industries, mature technologies tend to be licensed relatively freely, but maturity is a function of the pace of change in the industry. New developments in electronics—e.g., microcircuit designs—are licensed quickly because managers know that ongoing R&D will render them obsolescent in a relatively short time. If the company is not in a position to exploit these developments immediately, licensing may help defray part of the R&D costs.

Of course, licensing agreements themselves require management oversight; licensees or joint venture partners must be screened, deals evaluated, agreements negotiated. Once in place, the licensee's operations must be monitored; unsatisfactory performance can harm the licensor's reputation, perhaps threatening later opportunities for exploiting the technology. Companies go slowly when getting into licensing for the first time. Still, the managerial demands tend to be far less than for an initial foray into exporting or overseas manufacturing.

As noted in box W, cross-licensing agreements—where firms agree to share each other's developments—have become increasingly common. Royalties may or may not be involved, depending on the match between firms in terms of development capability. OTA interviews indicate that more and more license agreements involve two-way flows of technology. A significant proportion of licensing in the pharmaceutical industry, for example, is done on a quid pro quo basis—i.e., one technology for another. Particularly in industries where few companies can afford to stay abreast of all relevant technologies, exchanging R&D results helps both parties. Companies can target their efforts on quite specific needs, getting complementary knowledge elsewhere.

The growing number of international cross-licensing agreements illustrate one way in which corporate managements have begun using licensing for strategic purposes. As companies seek to control and apply technical knowledge to reap longer term rewards, licensing becomes increasingly integrated into the broader strategic view of upper level managers. For example, in earlier years, when countries like Japan closed their markets to exports or FDI, American companies frequently licensed unaffiliated companies to manufacture and market products locally, subject only to the usual royalty arrangements. Today, the impacts of such licenses on other aspects of the firm's domestic and international business get much more attention. An MNC might seek to tie new agreements to the purchase of components which themselves contain proprietary, but not licensed, technologies (e.g., a microprocessor chip set). In this way, the MNC assures continuing product exports, while also controlling the licensee's use of the transferred technology. Some know-how might be licensed, with related information held back. A communications equipment manufacturer might license a foreign firm to produce fiber-optic cable on the condition that connectors and amplifiers be imported. In a very real sense, the licensee

Box W.—Who Licenses, and Why?

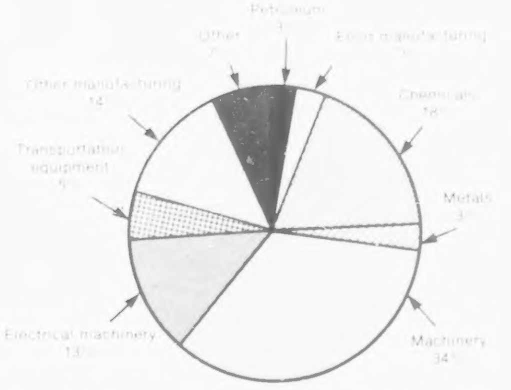
Many of the larger firms from the Fortune 500 list have hundreds, even thousands, of overseas licensing agreements in force.[1] Manufacturing companies, of one sort and another, account for the vast majority of the Nation's outward licensing (figure 42), with most of the rest involving companies that conduct R&D as a business—not only contract research firms, but new research-based enterprises that have not yet reached the stage of manufacturing. Figure 42 gives the distribution by industry of parent firm for U.S. licensing receipts (affiliated plus unaffiliated) in 1982. Manufacturing accounted for 93 percent of the total, with two industries responsible for more than half of all receipts—chemicals (including pharmaceuticals) and machinery (much of which consists of office and computing machines, although no breakdown is available). Electrical machinery, which includes electronic components, accounts for another 13 percent.

As pointed out below, a number of biotechnology startups have licensed quite actively overseas—to generate needed flows of cash from their research, or to trade technology for capital. Often they cannot afford the scale-up and marketing expenses needed to utilize the knowledge flowing from their R&D. A few American companies develop technology solely for license—e.g., process technologies for the petrochemical industry. Occasionally, individual inventors license their patents. Licensing has always been more common in research-intensive industries, where many companies count on licensing revenues to help pay for ongoing R&D. Figure 43 shows that, on average, licensing receipts cover more than a quarter of the R&D expenses for U.S. firms in the machinery industry; the fraction is probably somewhat higher for office and computing machines.

In the pharmaceutical industry, about 20 percent of all new products introduced stem from licensed technologies rather than internal developments. High product development costs mean that, worldwide, perhaps 20 to 30 large companies have been able to keep up across a broad front. Many smaller firms routinely license to larger companies with more resources for bringing new products to market. The patterns, of course, are not static: some companies, like Marion Laboratories, that once licensed all their new technologies from outside firms have now begun internal product development programs; others, such as Lilly, still neither buy nor sell technology.

Conditions in a particular industry may, in essence, force a company to license. Most semiconductors are sold to companies making products like computers and communications equipment. When major customers insist on multiple sources of supply, an innovator may have little choice but to license a new integrated circuit design to competitors.[2] To sell to foreign customers may mean licensing foreign competitors. Ac-

Figure 42.—U.S. Receipts of Royalties and Fees by Industry, 1982



SOURCE: *U.S. Direct Investment Abroad: 1982 Benchmark Survey* (Washington, DC: Department of Commerce, 1985), pp. 338-339.

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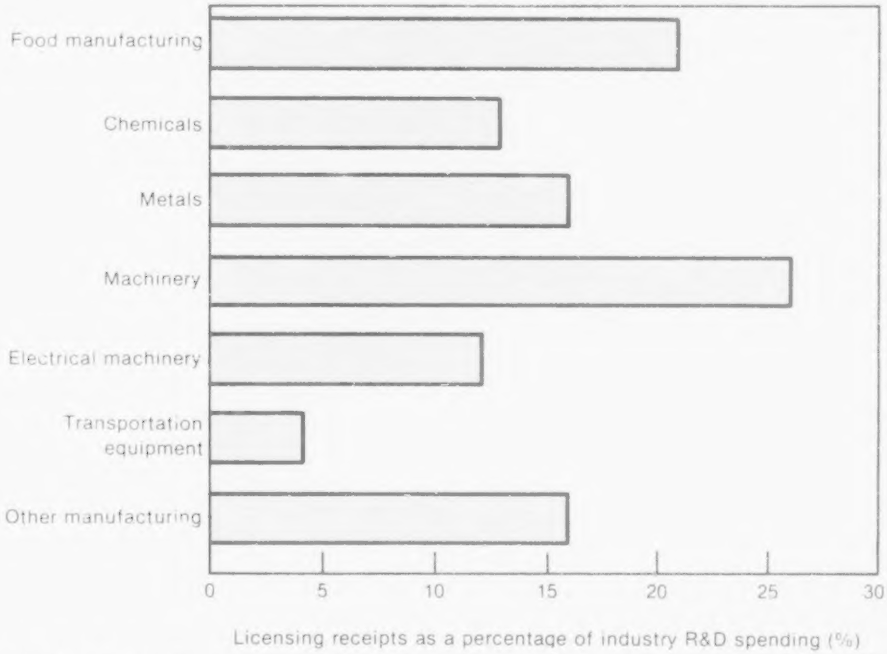
[1] F.J. Contractor, *International Technology Licensing: Compensation, Costs, and Negotiation* (Lexington, MA: Lexington Books, 1981), pp. 57, 96.

[2] In recent years, formalized alternate sourcing agreements have largely (but not completely) replaced the copying that was once so frequent in this industry. See, for example, "Trade Ethics in Silicon Valley," *New York Times*, June 25, 1982, p. D1; F.C. Klein, " 'Reverse Engineering' Of Microchips Is Slow, Costly—and Universal," *Wall Street Journal*, Aug. 5, 1982, p. 1; M.W. Miller, "Intel Charges NEC Illegally Copied Microchip Designs," *Wall Street Journal*, Feb. 27, 1985, p. 28.

In other industries, particularly those relying on proprietary manufacturing techniques, reverse engineering may be impossible. Given a complex macromolecule—e.g., a polymer or genetically engineering organism—there is no way to deduce with certainty how it might have been produced. The more process steps, the more difficult it is to work backwards.

Figure 43.—Royalties and Licensing Fees As a Percentage of R&D Spending in U.S. Manufacturing Industries, 1982



SOURCE: *U.S. Direct Investment Abroad: 1982 Benchmark Survey* (Washington, DC: Department of Commerce, 1985), pp. 338-339.

tive assistance to second-sources may help the innovator establish its design in the marketplace. Indeed, second-sourcing is one of the few cases in which an electronics company might license so-called trade secrets. In the extreme, it may be the only way to capitalize on a new design; that is, the innovating company may have to help its competitors get into production in order to sell at all. Given the way the semiconductor market operates, companies may also cooperate in developing the members of a family of chip designs. In such industries—where the pace of technical development is rapid, and markets volatile and hard to predict—arrangements involving licensing, cross-licensing, second-sourcing, and joint product development function as risk-sharing mechanisms. Managers may choose a reduced share of a more certain market, particularly a rapidly growing market, rather than chance going it alone.

Cross-licensing, in particular, offers further examples of risk-spreading. In industries such as computers and microelectronics, many companies have opted for cross-licensing—usually covering patented technologies only—with almost any firm, domestic or foreign, capable of generating knowledge comparable to its own. One reason is simply to gain access to technologies that can help in filling out product lines. But why should potential competitors agree in advance to share *all* patents? According to OTA's interviews, perhaps the most important reason is simply to avoid having to perpetually monitor possible patent infringements all over the world; executives in one company stated that, without wholesale cross-licensing, they would be engaged in lawsuits nearly everywhere. By the same token, they avoid worrying about infringing others' patents.

Litigation can nonetheless follow if cross-licensing relationships break down. Early in 1986, Texas Instruments (TI) filed process patent infringement suits against eight Japanese and one Korean firm for selling random access memory (RAM) chips without licenses under TI patents. According to TI, the nine companies had been licensed in the past, but the contracts had expired and negotiations for renewal had not been completed; a company spokesman suggested that the suit might speed progress toward new agreements.[3] TI asked the U.S. International Trade Commission to recommend that imports of RAM chips as well as downstream products using them, including mainframe computers, be banned from U.S. markets. In response, one of the Japanese companies, NEC, filed a patent infringement suit in Tokyo against TI-Japan, while another filed a patent infringement counterclaim against TI in the United States. Some of these cases have now been settled; others remain unresolved.

Like semiconductor manufacturers, new biotechnology firms have often found themselves forced to license, but for different reasons. These firms may have a competitive advantage in drawing on the pool of research results in genetic engineering, but face difficulties in commercialization. Not only is substantial investment capital often required, but so is a broad range of scientific and technical expertise. Scale-up from laboratory batches to commercial production has been a common problem; regulatory approvals may pose an unfamiliar set of hurdles. Under such circumstances, a relatively small biotechnology firm may simply find itself stretched too thin; it might seek partners, consider contracting with another company to undertake manufacturing, or it may license. Under such circumstances, a foreign partner may be more attractive because the originator can retain the U.S. market for itself. Further, because of Food and Drug Administration regulations prohibiting exports of new drugs before they have been approved in the United States, a foreign firm may be able to get approvals and introduce the product more rapidly overseas.

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[3] *Electronic News*, Mar. 17, 1986, pp. 38-41; "Texas Instruments Reports on Company's Improvement Into First Quarter of 1986," *PR Newswire*, Apr. 17, 1986; P. Duke, Jr., "Patent Lawsuits Against Sharp, Fujitsu Settled," *Wall Street Journal*, Jan. 12, 1987, p. 8.

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can become integrated into the MNC's own global operations.

Still more complicated examples are appearing. Recent reports suggest that some U.S.-based electronics firms have turned to licensing and joint ventures to help fend off Japanese competition. By licensing their technologies in South Korea, they hope to aid Korean firms in becoming effective competitors in the Far East, putting pressure on the Japanese in markets that the latter have regarded as their own.[18] The logic appears to be as follows. Japanese manufacturers have been able to achieve economies of scale in controlled Far Eastern markets, gaining advantages in production costs that help them move into the United States (and elsewhere). Korean competition, created in part through help from American firms, would reduce this source of advantage by attacking the Japanese in their traditional markets.

Strengthening potential new competitors in the Orient might seem a short-sighted approach to an immediate problem, given that the Koreans themselves are already becoming formidable competitors in some U.S. markets, as well as third countries historically served by American firms. Obviously, U.S. managements know the strategy could backfire. Evidently, they feel it is better to face two or more independent competitors than a single set of national firms acting in what many American executives believe to be concerted fashion. As pointed out above, Japanese companies have themselves been reluctant to license technologies in Korea that might threaten their own international market positions—evidence that the Japanese will take this U.S. strategy seriously.

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[18] On joint ventures between Korean and American firms, see S. Chira, "U.S.-Korea Ventures Strive for Compatibility," *New York Times*, Mar. 28, 1986, p. D1; also, J.R. Schiffman and M. Shao, "South Korea and Taiwan: Two Strategies," *Wall Street Journal*, May 1, 1986, p. 36. In the semiconductor industry, more than a dozen agreements were signed during 1985 and 1986 between U.S. companies and Korean firms such as the Lucky-Goldstar Group, Hyundai, and Samsung. The three Korean manufacturers have reportedly invested nearly a billion dollars in building their semiconductor capability.

The primary point, then, is that licensing has become—not only a means of exploiting technical advantages—but a tool for developing counter-strategies against international competitors. American managers are coming to realize that gaging foreign market possibilities simply in terms of cash flows, the conventional measure of opportunity, is no longer sufficient. Entering some markets, even in modest fashion, may force competitors to alter their own strategic approaches in ways that can benefit the U.S. position.

Joint Ventures

A number of the arrangements between U.S. and Korean electronics firms have taken the form of licensing to a joint venture in South Korea—an increasingly common pattern. Motives for joint ventures linking companies that normally compete range from market entry for one of the partners to efforts to limit exposure in an unfamiliar setting. American firms have sought joint venture partners in Japan to get help in penetrating the mazelike Japanese marketing and distribution system, or to do business with such enterprises as NTT (Nippon Telegraph and Telephone), which have traditionally purchased from a small family of Japanese suppliers.

Many joint ventures involve technical licensing by U.S. companies, perhaps as an equity contribution; the American firm Halcon International licensed its ethylene oxide technology to a Brazilian manufacturer in exchange for a 10 percent ownership interest (beating out Shell, which had sought its own plant but could not get approval from Brazil's Government). In other examples, AT&T has purchased a 25 percent stake in Olivetti as a means of distributing its computers in Europe, while establishing a 50:50 joint venture with the Dutch firm Philips in order to enter European telecommunications equipment markets; licensing of AT&T technology is part of both agreements.

Escalating costs have also pushed firms to cooperate. International Aero Engines, which links three European and three Japanese companies with the American firm Pratt & Whitney, is undertaking a billion-dollar development effort that would be highly risky, if not impossible, for the participants individually. R&D costs likewise were a major reason for the formation of the Texas-based consortium Microelectronics and Computer Technology Corp. (MCC). As this example and Japan's fifth-generation computer project (ch. 5) both suggest, R&D joint ventures tend to be more common within nations, but they are becoming familiar internationally as well.[19] In a typical arrangement, two or more firms from different countries combine in a new company, jointly owned, to develop technologies that can be shared through cross-licensing between the joint venture and each partner. Usually, the technical agenda is tightly focused, serving to bring to bear the individual strengths of the partners on problems of common interest. Thus, Sony in Japan and Advanced Micro Devices (AMD) in the United States are cooperating on very large-scale integrated circuits. AMD expects to increase its sales to consumer products manufacturers, Sony to benefit from AMD's experience in chips for computer systems.[20]

The success of such combinations depends on each partner meeting its own objectives (which may involve matters such as taxes, financing, and risk, in addition to technology).

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[19] Also see the discussions of European programs like ESPRIT and Alvey in ch. 9.

A recent survey of cooperative agreements and joint ventures covering nearly a thousand companies operating in Europe found that more than half were intended to transfer or share technology—E. Ricotta, "Joint Ventures and Inter-Company Agreements in High-Technology Sectors," mimeo, Dec. 13, 1985. Most of the agreements had been negotiated between European and non-European (typically American) firms, with the electronics industry accounting for many more than any other sector, 44 percent of the total. Slightly more than one-third were restricted to marketing/distribution, slightly fewer involved production.

[20] Each company will have the right to market the other's products under its own name. See L.M. Fisher, "Micro Pact With Sony Is Planned," *New York Times*, Feb. 13, 1986, p. D1.

OTA's interviews offer insights into the pros and cons of joint ventures. As one corporate manager put it, "The difference between licensing and joint ventures is that in licensing you sell your product, while in joint ventures there is joint control, joint management, and joint risk. There are more revenues with joint ventures, but you need more cash up front." Another noted that "Joint ventures require tremendous on-going care and nurture. It's like a marriage; if interests begin to diverge, the venture may flounder." Also see L.H. Young, "The Corporate Links Abroad," *New York Times*, Aug. 6, 1986, p. D2.

If one partner benefits disproportionately—as some observers see happening in joint ventures linking U.S. and Japanese companies—the combination will not last long.[21] In OTA's interviews, managers in smaller American companies, faced with difficulty in keeping up with new technologies, expressed more interest in such undertakings. Despite such examples as International Aero Engines and MCC, larger enterprises with long-established R&D operations tend to be more skeptical, taking the view that quite special conditions are needed to make joint ventures attractive.

Acquisition of Foreign Technologies

As the balance of payments figures on licensing presented earlier in this chapter demonstrate, U.S. companies have sought foreign R&D results far less often than they have transferred their own technologies abroad. With comfortable leads, where was the need? Although exceptions have always existed, as when U.S. firms licensed the Pilkington process for plate glass, or when DuPont began making polyester under license from British Calico Printers, the rule was to ignore technical knowledge developed abroad. Today, the rules have changed—although some American firms seem not as yet to have realized it. In industry after industry, American technology is little if any better than that of foreign manufacturers. In a surprising variety of cases, foreign firms have moved ahead—automobile technologies ranging from combustion system designs to active suspension control, consumer electronics, some kinds of steel-making and machine tool technologies. As a result, American managers are beginning to view acquisitions of foreign technology as a necessary part of their own planning, a complement to internal R&D. When General Electric decided to enter the industrial robot market, the company screened and evaluated technologies globally, eventually selecting know-how from Japan, West Germany, and Italy.

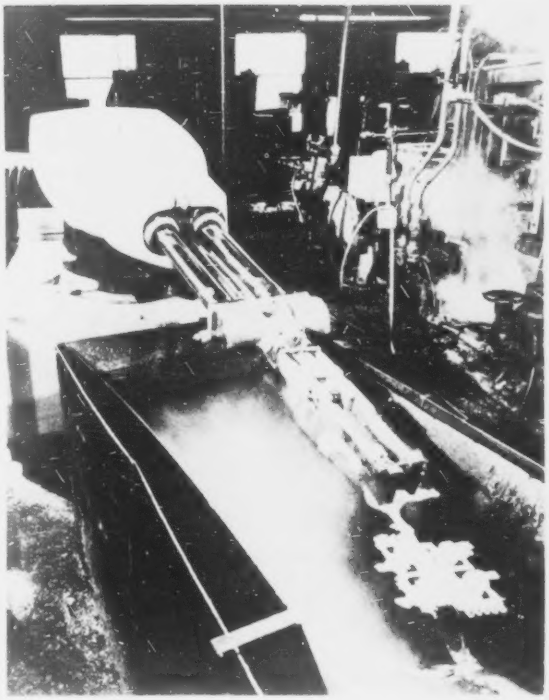

Photo credit: Unimation

Industrial robot

Greater need to specialize in their development efforts also drives U.S. companies to seek know-how overseas. With R&D costs rising rapidly in some fields, even companies as dominant in their industries as IBM cannot aspire to excel in all technologies related to their products. As a result, more and more companies are seeking to identify the technologies most important in their primary lines of business—their core technologies—and concentrate their resources on them. Other technologies they shop for, and, increasingly, shop internationally. At the same time, many U.S. firms that could plainly improve their competitive ability through the acquisition of foreign technologies fail to recognize their needs, the opportunities, or both.

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[21] See R.B. Reich and E.D. Mankin, "Joint Ventures With Japan Give Away Our Future," *Harvard Business Review*, March-April 1986, p. 78, who seem to think that, somehow, American companies can never win in business arrangements with the Japanese. For a more balanced view, see D.C. Mowery, *Alliance Politics and Economics: Multinational Joint Ventures in Commercial Aircraft* (Cambridge, MA: Ballinger, 1987).

On some of the broader, strategic aspects of joint ventures, see K.J. Hladik, *International Joint Ventures* (Lexington, MA: Lexington Books, 1985), pp. 27-28. Hladik relates that Egypt barred Coca-Cola from bottling and selling its products from 1967 to 1977 because the company had franchised a plant in Israel. The ban was rescinded after Coca-Cola entered a joint venture with Egypt's Government to grow citrus in the desert.

POLICY ISSUES

The earlier sections of this chapter raise three rather different sets of policy issues. The first consists of U.S. Government policies that affect licensing itself—questions such as intellectual property protection, export controls, and antitrust restrictions on licensing contracts. The second set of issues, far broader, and dealt with below in greater detail, concerns the Nation's technology base, and the policies that contribute to strengthening it (e.g., through R&D) and to utilizing it (e.g., by facilitating diffusion of technologies within the U.S. economy). Third, foreign governments have become much more sophisticated in their use of policy tools to encourage technology transfers from U.S.-based firms, raising questions of the appropriate response by the U.S. Government. Specific policy options, once again, have been left for chapter 10.

The Policy Environment for Licensing

Legal rights granted by governments in the form of patents, copyrights, and trade secrets underlie international trade in technology, with patent and trademark licensing particularly important in industries including chemicals, pharmaceuticals, and food products.[22] Because stronger protection for intellectual property has become a U.S. negotiating objective in the Uruguay Round of trade talks, it is discussed in that context in chapters 9 and 10.

Export controls have been a contentious matter for years, with Congress amending the Export Administration Act of 1979 in 1985. The Act authorizes restrictions on exports, including international transfers of technical information, for reasons of national security. The major objective of these controls is to prevent, or at least slow, flows of technology having potential military applications to the Soviet Union and its Eastern European satellites. A history of policy controversy within the Federal Government has meant continuing uncertainty. Delays in the processing of applications covering proposed licensing agreements have sometimes been lengthy. Managers interviewed by OTA claim that foreign companies sometimes avoid U.S. sources of technology because of the possibility of delays and constraints on their use of licensed know-how. H.R. 3, the omnibus trade bill passed by the House of Representatives in April 1987, incorporates further amends to the Export Administration Act.

Until the late 1970s, the Antitrust Division of the Department of Justice maintained a published list of nine licensing practices considered per se violations of the law. American companies could not insist on contract provisions barring foreign licensees from using transferred technology to sell in the United States. Nor could they control their licensee's prices. While other per se violations pertained only to domestic licensing, business executives and their lawyers could never be sure that the Justice Department would not extend these constraints to the international sphere. As a consequence, most American companies steered clear of such provisions in their contracts with foreign firms. In the view of most managers, the list of per se violations discouraged licensing by reducing the firm's ability to control its proprietary technology.

Beginning during the Carter Administration, but especially since 1980, the Justice Department has modified its view of antitrust enforcement, with officials articulating considerably more tolerant standards.[23] In the new view, al-

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[22] *Licensing in International Strategy: A Guide for Planning and Negotiations*, op. cit., p. 125.

Given the ways in which technology has been evolving, piecemeal revisions to legal protections for intellectual property seem increasingly inadequate, as discussed in more detail in ch. 9. Also see *Intellectual Property Rights in an Age of Electronics and Information* (Washington, DC: Office of Technology Assessment, April 1986).

[23] For instance, "Remarks of Charles F. Rule, Deputy Assistant Attorney General, Antitrust Division, U.S. Department of Justice, 'The Antitrust Implications of International Licensing: After the Nine No-Nos,' Before the World Trade Association and the Cincinnati Patent Law Association," Oct. 21, 1986.

On U.S. antitrust law in general, see *U.S. Industrial Competitiveness: A Comparison of Steel, Electronics, and Automobiles* (Washington, DC: Office of Technology Assessment, July 1981), pp. 184-185; and *International Competitiveness in Electronics*, op. cit., pp. 390 and 465. The National Cooperative Research lowing a licensor to place limitations on a licensee's freedom of action, domestic or international, can lead to more competitive markets, greater efficiency, and higher levels of R&D spending. Restrictive provisions in licensing agreements, therefore, should not be assumed anticompetitive per se, but rather be evaluated on a case-by-case basis. Because of this well-publicized shift in antitrust policy, managers express far less concern about inserting restrictive clauses in licensing agreements than during the 1970s. Corporate legal departments, nevertheless, continue to urge conservatism—their job as they see it—given that the more relaxed enforcement attitudes have not yet been supported by clear case precedents.

The actual impacts of the new policy stance, as they relate to technology development, remain to be seen. While abandoning per se violations may stimulate technology development by increasing potential rewards to innovators, such conjectures remain, for the moment, in the realm of theory. Caution seems in order, if only because of examples of past policy shifts with smaller than predicted impacts (R&D tax credits, ch. 10). Beyond this, some of the lessons of the past seem to have been overlooked. Strict enforcement of antitrust laws in earlier years clearly led to enhanced technology diffusion, and thus greater competition, in some industries. The obvious case is the mandatory licensing of patents flowing from Bell Laboratories under the AT&T consent decree of 1956, which helped stimulate the enormously dynamic merchant semiconductor industry. This industry would look considerably different had AT&T been allowed to hold its technology then as closely as it does today. Similarly, the independent computer software industry in the United States—which developed much faster than in other countries (ch. 5)—owes much of its rapid start down the learning curve to IBM's unbundling of software sales from hardware. IBM took this action in 1969 only under threat of antitrust proceedings. Given such examples, it seems reasonable to ask whether U.S. high-technology industries would exist in anything like their present form if today's antitrust climate had existed during the 1950s and 1960s.

R&D and Technology Development

Earlier sections of this chapter stressed that competitiveness in supplying technology, or, more broadly, in trading technically based goods and services, depends on R&D directed at commercial technologies—and not only R&D, but the diffusion of results. Both development and diffusion depend to considerable extent on government policies.

In the United States, the Federal role has been twofold. Government agencies have provided most of the financial support for R&D related to national defense and space exploration. Sometimes this funding has contributed to strong, internationally competitive industries: e.g., digital computers, commercial aircraft. Second, the Federal Government has funded most research in basic science. Here the justification has been essentially economic: without government assistance, the private sector would underinvest from a societal point of view. Government funding enlarges the pool of basic scientific knowledge, which then becomes available to all potential users. The fruits of this policy have been especially evident in industries that utilize research results flowing from health-related R&D.

As a rule, many years separate the generation of new scientific knowledge from commercial application. Furthermore, much defense-related R&D is not only narrowly specialized, but classified, and not readily available to companies outside the community of aerospace firms and military contractors. This alone delays commercial applications, even though the proportion of military funds going to applied R&D, as opposed to basic research, far exceeds that in most other Federal agencies. (Basic research, almost by definition, tends to be well removed from possible incorporation in commercial products.)

(continued from previous page)

Act of 1984, which explicitly permits certain forms of joint R&D, has been the only recent change in the statutes to be enacted by Congress. During 1986, the Justice Department proposed a series of five bills, including amendments to the Clayton and Sherman acts, that would relax existing law substantially.

The Federal Government has seldom funded technology development closely tied to commercial products and processes. Despite exceptions such as energy R&D during the 1970s, commercial efforts have normally been left to private firms. In part, this choice reflects a belief that government should avoid competition with the private sector. In addition, many observers believe that government involvement would inevitably lead to distortions in the market, hurting some companies while helping others. Thus, U.S. technology policy has operated on the principle that, since private firms derive the primary benefit from commercial technology development, they should foot the bills.

The gray areas—energy-related research, some civil aviation technologies, a good deal of health-related R&D —typically fall in what has been called generic or pre-competitive technology development: R&D necessary for building a knowledge base to support *all* companies in an industry. In this sense, the argument for supporting pre-competitive technologies is much like that for basic research. Benefits that might be elusive and indirect for an individual firm may nonetheless yield large social benefits.

The Reagan Administration's policy has been to withdraw support from the gray areas, and count on the private sector to support them. The government has, at the same time, stepped up defense R&D, which in 1987 will, together with space, account for nearly 80 percent of Federal R&D dollars. Federal spending for basic research in the physical sciences has also been growing relative to other parts of the government R&D budget, with non-defense applied research shrinking dramatically. Finally, the Administration has increased funding for research in engineering, primarily through the National Science Foundation (NSF), and in part because of concern over lagging U.S. competitiveness (ch. 10).

Some defense-related technologies have substantial commercial spillovers. For example, the Department of Defense spends a good deal of money on computer research and on very large-scale integrated circuits. But in other countries, government support for similar research might center more directly on commercial product development (see ch. 9). If past history is a guide, significant commercial applications of the results of defense-related research will be the exception, not the rule.[24] Put differently, if commercial technology development is the goal, military R&D is not an efficient means to reach it.

Other governments have often designed special programs aimed at improving national capabilities in advanced technologies of commercial significance. Prominent examples include Japan's fifth-generation computer project, and related software development efforts (ch. 5). The fact is that most other industrialized nations devote a larger fraction of government R&D spending to projects directly related to industrial technologies. In biotechnology, for instance, while the United States has the largest and most extensive basic research effort in the world, the Japanese Government leads in its commitment to generic and applied research.[25]

Diffusion of R&D results raises a similar set of issues. Government-sponsored programs in other countries frequently combine support for technology development with efforts to transfer technology to industry, seeking to speed adoption and cut learning costs. Moreover, as noted earlier in this chapter, given rough technological parity in many fields, American companies now have a good deal to learn from overseas. But, in part because the United States was ahead for so long, mechanisms for learning from foreign experience remain poorly developed. Chapter 10 discusses policy options for strengthening these mechanisms.

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[24] "Development and Diffusion of Commercial Technologies: Should the Federal Government Redefine Its Role?" staff memorandum, Office of Technology Assessment, Washington, DC, March 1984.

Compared with efforts abroad, the impacts of greater Federal funding for NSF's engineering research will be small. The sums involved are simply not great enough to make much difference, given the trends examined earlier in the chapter; NSF's budget for engineering during fiscal year 1987 comes to $163 million out of a total NSF research budget of $1.62 billion.

[25] *Commercial Biotechnology: An International Analysis* (Washington, DC: Office of Technology Assessment, January 1984), pp. 505-510.

Foreign Government Policies

Less developed and newly industrializing countries have been much more likely to restrict foreign direct investment than the advanced nations. Broadly speaking, the LDCs and NICs have sought to control investment in pursuit of three interrelated goals:

1. *Economic Growth.*—Many governments regulate inward investment, seeking to steer foreign capital to sectors considered desirable for fostering economic growth and development.
2. *Technology Transfer.*—By permitting FDI only if accompanied by transfers of technology, governments have sought to build their infrastructures and develop a skilled labor force.
3. *Autonomy.*—Closely related to the first two objectives, many developing countries wish to limit production and market share by foreign-based MNCs in key economic sectors, reserving these for their own companies.

From the U.S. perspective, the policy issue that arises is straightforward. Foreign government policies can distort corporate decisions concerning the use of proprietary technologies. The consequences may be harmful to U.S. interests. Most obviously, in the absence of foreign government incentives and/or restrictions, American companies might use their proprietary technologies to produce at home and export. Of course, such considerations cut two ways. The U.S. Government has imposed restrictions on imports, or threatened to, with increasing frequency since the middle 1970s. As a result, foreign firms in industries ranging from consumer electronics to automobiles have opened manufacturing plants in the United States.

In fact, many governments have a schizophrenic attitude toward MNC involvement in their economies. On the one hand, they may encourage inward investment through incentives including low-interest loans, tax rebates, training grants, and tariff and foreign exchange preferences. Typically, governments offer such incentives to companies they wish to attract—i.e., those whose presence is consistent with policymakers' views on development needs. But selective investment incentives may conflict with objectives related to technology transfer and autonomy. An MNC that accepts the incentives will want to conduct its business much as it does elsewhere, integrating its local operations into the global enterprise. For example, the MNC might wish to license a subsidiary, although the government prefers that technology be transferred to locally owned firms. If the government insists on a joint venture as a condition of entry, perhaps with the multinational taking a minority position, the MNC's choice can be a painful one: share its proprietary technology with a local partner, and risk losing control, or forgo the prospect of present and future business in that country. Needless to say, different companies make different decisions in such circumstances, depending to some extent on the strengths of their bargaining positions.

It is also true that many foreign joint ventures simply reflect strategic needs, with little or no influence from foreign government policies. As pointed out earlier, joint ventures can reduce risks in unfamiliar markets—limiting financial exposure while drawing on the experience of local firms familiar with marketing and distribution practices. Although direct investment and joint venture decisions may reflect foreign government policies, they may at the same time reflect the firm's desire to pursue an integrated international strategy. Indeed, most American managers view government efforts to manipulate markets as just another exogenous element to be fitted into the strategic puzzle.

Other foreign government policies affect licensing more directly. Taxation of corporate income but not of royalty flows encourages licensing of affiliates, with royalties becoming one method for transferring funds within the MNC. For this reason, host governments may tax international transfers involving royalty payments. In addition, with foreign exchange a scarce resource in most developing economies, governments often seek to control international payments directly. As with many such regulations, governments tend to use rules of thumb. These typically constrain allowable royalties to a narrow range. Licensors might find the permissible royalties adequate, even generous, for some technologies, but quite inadequate for others (when set against the risks of losing control of proprietary know-how). A country that restricts royalties too tightly, thus cutting itself off from some technologies, may complain about the monopolistic practices of multinationals, even though the royalties in dispute may the norm in other parts of the world. The result? Lower levels of licensing revenue for the U.S. company, coupled with less technology of potential use to the developing nation.

Finally, governments sometimes attach direct conditions to licensing agreements—attempting, for instance, to accelerate technology transfers through unusually short licensing periods. Both Mexico and Brazil limit trade secret protection to 5 years. In the view of most corporate managers, this is far too little time to permit adequate earnings from proprietary knowledge. Although renewals are possible, there are no guarantees. Such conditions, always accompanied by trade barriers, have caused many firms simply to stay away. At the same time, relatively large countries like Mexico and Brazil, with attractive potential markets, have considerable leverage. They have often been successful in playing foreign companies off against one another. In other cases, however, developing countries have lost the benefits of technology transfer by attaching conditions that foreign firms have been unwilling to accept. Brazil, for example, has established such stringent conditions relating to small computers that no company with up-to-date products has agreed to transfer technology.

CONCLUDING REMARKS

Technical knowledge spreads internationally through many channels other than licensing—when foreigners study engineering and science in American universities, later to return home, they take technology with them. Competitors engage in reverse-engineering, pervasive in the earlier years of the semiconductor industry. Foreign subsidiaries are staffed largely by local people; when they leave for other jobs, their knowledge goes along. In R&D alone, the overseas manufacturing affiliates of U.S. firms employed some 70,000 foreign nationals in 1982.[26]

With diffusion of technology inevitable, firms try to capitalize on it rapidly, before its value declines too much. In different circumstances, this may imply exporting goods (or services), direct investment, or licensing. Decisions on which technologies to license, and where, depend on a firm's strategic view. The company will look at the size of potential markets, at available close substitutes, at the risks of losing control over proprietary knowledge. An American firm may prefer to export but find dollar exchange rates discouraging. Foreign government policies may close off investment. If it wishes to license, it may be pushed toward joint ventures with local companies.

Among the risks that a firm must evaluate, perhaps the greatest is that it will lose future sales to its licensees. No matter how tightly the licensing agreement is written, defining precisely where and how the technology can be used, leakage and counterfeiting become more probable once the technology is in use in someone else's plant. Moreover, enforcement of the terms of the agreement can be difficult in a foreign country. All these factors make it difficult to set fees for technology licenses.

Given the risks and uncertainties, arms-length agreements—though large in number—remain small in value compared to licensing between affiliates. But it is also true that intra-corporate licensing remains largely hidden from the view of the U.S. Government, primarily because charges between divisions of the same company will seldom adequately reflect the value of the licensed technology. For this and other reasons, statistics on technology trade give little real sense of the impacts on international competition (or on domestic employment).

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[26] *U.S. Direct Investment Abroad: 1982 Benchmark Survey Data* (Washington, DC: Department of Commerce, December 1985), p. 243. Total employment in overseas manufacturing affiliates of U.S. firms came to 3.4 million. Of 76,000 R&D employees, no more than 6,500 were U.S. citizens.

For the United States, Europe remains the major trading partner in technology. European firms represent the largest source of licensing receipts and the largest recipient of U.S. payments, although inward transfers from Japan have been increasing more rapidly; technology imports from Europe grew by 19 percent between 1983 and 1985, but imports from Japan jumped by 29 percent.

Over the years, U.S.-based MNCs have begun transferring more advanced technologies; with foreign firms catching up, only the latest knowledge has value to them. As this and many other observations suggest, American firms do not have as strong a technological position, relative to the rest of the world, as they once enjoyed. By many indicators, U.S. priorities for non-military technology development have fallen below those of other countries, notably Japan. Although a weakened balance of payments position in licensing is among the less serious consequences of diminished comparative advantage in technology, it does have its effects. Moreover, the LDCs and NICs are demanding the most recent know-how, which makes it more difficult to hold on to the advantages that remain.

In interviews, many managers of U.S.-based firms stated that overseas exploitation of technological advantages has become more difficult in both developed and developing countries. While enterprising American firms have found ways of dealing with foreign government restrictions, more and more of the intracorporate avenues are being closed to them; the consequences include increases in joint ventures and arms-length licensing agreements. Given these circumstances, American firms increasingly employ licensing as one element in quite complex strategies. At least for larger multinationals, these are likely to be global in scope. Corporate managements spend a good deal of time positioning their firms for ongoing international competition. For firms whose advantages lie in technical knowledge, licensing becomes an integral part of forward planning.

What of the claim that, by underpricing their technology, American firms have helped foreign competitors catch up? In fact, matters are seldom so simple, as the following example illustrates. Texas Instruments, as is well known, used its patent position as a wedge to enter Japan's semiconductor market.[27] What is less well known is that TI's management believes strongly in onsite manufacturing as a necessity for competing in high technology. TI felt that, to sell in Japan, the company had to manufacture there. In 1968, it traded licenses—covering technology TI had already made available to its U.S. rivals, but no trade secrets—for permission to establish a 50:50 joint venture with Sony. TI insisted on the right to buy out its partner after 5 years, and thereafter operate a wholly owned subsidiary—a provision which it expected to exercise from the beginning, and did. Today, TI claims that it is gradually coming to be treated as a Japanese business. The company maintains cross-licensing agreements with all the major Japanese semiconductor manufacturers, and expects—like IBM before it—to enter into a cross-licensing agreement with MITI (important because many patents resulting from joint government-industry R&D revert to the Ministry). Did TI underprice its technology? While Texas Instruments evidently does not think so, the firm's U.S. competitors—which did not have strong enough technological positions to force their way into the Japanese market in earlier years—might well differ.

In any case, if American companies licensed technology to potential rivals in Japan under terms that—with hindsight—seem too liberal, most of these mistakes were made a decade or more in the past, before Japan's rising competitiveness was obvious to all. Few American managers would any longer underestimate their Japanese rivals. At this point, the pressing need is for better developed mechanisms through which U.S. firms, in many industries, can learn from foreign technical developments. A more rapid increase in inward licensing, implying broader recognition by U.S. industry of the need for two-way flows, would be a favorable sign for future U.S. competitiveness. But most important of all, U.S. policymakers need to attend to a pressing series of problems that affect the technology base for all of American industry. Many of the needs have been well-documented and widely acknowledged—e.g., lack of laboratory equipment in the Nation's universities. The problems have been identified, but they have not been solved.

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[27] *International Competitiveness in Electronics*, op. cit., pp. 140 and 193-194.

Chapter 7

Jobs in the Services

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Chapter 7

Jobs in the Services

SUMMARY

The number of people in the U.S. labor force has been growing much more rapidly than the total number of hours worked. The result? A great deal of slack in the labor market. Unemployment remains at historically high levels, although not so high as at the beginning of the decade. Among the employed, part-time and temporary work has been increasing. With American companies facing competition from a continually expanding number of technologically competent firms based in low-wage countries, U.S. wages and living standards, relative to the rest of the world, are being driven downward. The United States, like other Western economies, faces a future of chronic underemployment for many, and new labor market opportunities for groups such as urban blacks that seem quite limited.

This chapter examines U.S. employment patterns over the recent past—in terms of both service *industries* (regardless of occupation) and service *occupations* (regardless of industry). The growing percentage of the labor force working in service industries, and in service occupations in manufacturing industries, mirrors ongoing structural changes in the Nation's economy:

- rising imports culminating in huge trade deficits;
- rapid technological change, including automation in response to competitive pressures;
- shifts in demographics, social norms, and patterns of demand (the entry of the baby boom generation into the labor market, many more women seeking jobs, consumer preferences for small cars, many of them imported).

The jobs being created in the United States today differ on many dimensions from those of 15 years ago. Many of the new jobs in services pay poorly compared with manufacturing jobs, particularly those in the unionized smokestack industries. Unions themselves are in decline, part-time and temporary work on the rise. Competitive pressures, largely from abroad, have dampened wage growth, indeed forced wages down, in many manufacturing companies. As one response to new competition, American manufacturers have automated, cutting further into job opportunities. Hard-pressed firms in industries like autos and steel have slashed white-collar jobs as well as blue. The consequences come through with striking clarity in a comparison of manufacturing and service employment in the Pittsburgh area, where: 1) in 1982, pay in durable goods manufacturing remained nearly 50 percent higher than the average for the area, although dropping; 2) pay in trade (wholesaling and retailing, including restaurants) was 40 percent *below* the average, and pay in personal services 47 percent below average; and 3) fringe benefits dropped rapidly with take-home pay.[1] *Jobs in the services, in sum, are poor substitutes for jobs in manufacturing.*

Measured by the number of jobs created over the past decade, the U.S. economy has performed better than most other advanced industrial economies. But *many more Americans now have contingent or casual jobs than 20*

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[1] "Labor Mobility and Structural Change in Pittsburgh, 1977-82," prepared for OTA by L. Jacobson, The W.E. Upjohn Institute for Employment Research, under contract No. 533-6090. The report analyzes a unique database assembled from Pennsylvania unemployment insurance records.

Pay in durable goods manufacturing fell from 63 percent above the average in 1977 to 48 percent above in 1982.

In Pennsylvania as a whole over the period 1975-85, manufacturing employment dropped at an average rate of 1.63 percent per year, while rising at 2.75 percent per year in the services—L. Jacobson, "Job Creation and Destruction in Pennsylvania, 1975-85," report to the Organization for Economic Cooperation and Development, The Upjohn Institute for Employment Research, Nov. 17, 1986, p. 12.

years ago, as shown by the steady rise in involuntary part-time employment. By many indicators (e.g., purchasing power per hour worked), living standards in the United States are headed downward—a direct consequence of competition from low-wage economies in other parts of the world. Given open U.S. markets, and steadily improving technological capabilities in large numbers of developing countries—nearly all with substantial labor surpluses that promise to hold wages far below U.S. levels—competitive pressures can only intensify. Many Americans who entered the labor force in the 1970s and 1980s will never earn as much, in real terms, as their parents. At least until the baby boom generation passes through its prime earning years, competition among Americans seeking jobs and advancement in the U.S. labor market promises to be just as intense as competition among U.S. and foreign firms in the world economy.

At the same time, a minority of skilled and professional jobs in the services offer, as always, lucrative opportunities for physicians, attorneys, stockbrokers. While many and diverse patterns characterize work in the services, the mobility patterns suggested by a listing of such professions seem to be growing more common (in the services and thus in the U.S. economy as a whole). That is, upward mobility depends on the right kind of entry-level skills and credentials.

Two or three decades ago, Americans could climb mobility ladders in many of the services much like those in manufacturing, with greater responsibilities and greater rewards in the form of pay and perquisites for those who succeeded or simply accumulated enough seniority. It was possible to move from a sales job in a department store to a position as buyer (roughly equivalent to a departmental supervisor), and perhaps even store manager. Many of those opportunities are gone: *new technologies and the rise of higher education have knocked the rungs out of mobility ladders in many companies*. These companies now tend to hire people with the skills they need from outside, rather than promoting (and training) current employees. As the external labor market replaces internal markets, buyers and managers come from the ranks of college graduates, often with specialized degrees such as MBAs. Like the nurse—who cannot become a physician through on-the-job advancement—a sales person or clerk who wants to move very far upward will need a new set of credentials. If nothing else, employers view a college degree as evidence of the ability to learn—of retrainability.

In effect, more of the services are becoming professionalized. One consequence is to sharpen many of the differences in work setting between jobs in the services and jobs in manufacturing—differences that create substantial barriers to mobility for displaced manufacturing employees. In addition to facing the prospect of substantially lower pay, an unemployed steelworker is unlikely to feel at home in a bank or insurance office.

As many examples suggest, labor markets in the services tend to fit a two-tier pattern, with sharp divisions between professionals (and others with specialized skills) and people with lower skills and lower pay. To the extent that these patterns broaden and persist, they will aggravate the stratification already found in the U.S. labor force: if it is too simple to speak of a two-tier structure in the labor force as a whole, with a small fraction of highly paid people at the top, while the vast majority have low pay and few prospects, it is certainly not too simple to speak of a segmented labor market, in which moving upward will be possible only for people with unusual abilities and ambition.

What does international trade and competition have to do with the picture sketched above? Most of the impacts are indirect. Neither the statistics nor the case examples in the body of this chapter can be tightly linked to exports and imports of services, which—as shown in chapter 2—remain relatively small. With exports of services less than a fifth of goods exports, relatively few American jobs depend directly on foreign sales of U.S.-produced services. Certainly trade helps create domestic jobs in many service industries: the motion picture business gets much of its revenue from overseas rentals; Japanese and European banks in New York and

San Francisco hire many Americans. But, for the U.S. economy as a whole, the indirect effects—for instance, through service inputs embodied in exports and imports of goods—are much greater.

Service companies in many industries market their products primarily to manufacturing firms, while many American jobs in the intermediate or knowledge-based services support the activities of overseas affiliates of U.S.-based firms. Beyond this, about 40 percent of Americans employed in manufacturing industries perform service functions. Jobs in the services may replace some jobs in manufacturing, but they also depend on jobs in manufacturing—and on the continuing competitiveness of the manufacturing sector of the U.S. economy.

Other indirect impacts are more subtle. Pervasive competitive pressures on American service and manufacturing firms, stemming from domestic deregulation as well as from imports, have forced companies to reassess their business strategies. Many have sought to cut costs and improve their flexibility by replacing some of their full-time employees with part-time or temporary workers. Not only does this help meet fluctuations in demand (day-to-day or seasonal, as in banks and department stores, as well as fluctuations tied to the business cycle), but companies can hold down their hourly costs, for fringe benefits as well as direct pay.

Since the middle 1970s, the number of contingent workers in the U.S. labor force—those without formal or long-lasting ties to a company—has grown steadily. The majority hold part-time jobs or are self-employed. When temporary and contract employees are added, together with illegal immigrants and those working at home or in the underground economy, *contingent workers total well over a quarter of the Nation's labor force.* (Most of the work in the underground economy is simply unreported, not otherwise illicit or illegal.)

In effect, companies have been able to push much of the risk associated with business downturns onto their employees. During 1985, about 5.5 million Americans employed part-time wanted full-time jobs but could not get them (another 8.3 million were unemployed). The trends outlined in this chapter suggest that American service firms (and manufacturers) are attempting to control costs and achieve flexibility in part by using workers who receive few fringe benefits and little training, whose hours can be varied to meet fluctuations in demand, and who can be laid off more easily than regular employees.

Given a slack labor market that has seen involuntary part-time work rising for years, greater reliance on contingent workers becomes an easy and obvious adjustment, at least in the short run, for companies faced with greater competitive pressures. Somewhat greater commonality of skills across industries—e.g., in computer-related occupations—makes it easier for firms to tap part-time or temporary workers as needed (while giving employees more scope for horizontal mobility—although this may be a poor second to vertical mobility). But job ladders in the normal sense seldom exist for contingent workers, and over the longer term, *companies that rely too heavily on part-time and temporary employees may well find themselves with a work force lacking the skills and experience base needed to meet new competition.*

OTA makes no attempt in this report to project future employment in the service industries. A quantitative assessment would require sector-by-sector analyses, including the indirect impacts of new technologies and international trade and investment. This chapter aims, instead, at a summary picture of U.S. employment patterns, one that highlights service industries and service occupations. The later sections, touching briefly on the effects of immigration and work in the underground economy, show that the jobs taken by immigrants, legal and illegal, and the choices made by Americans who work "off the books" fit consistently into the larger picture. Immigrants divide sharply into those with high skills and professional credentials (nurses and physicians from the Philippines, engineers from Taiwan) and those with low skills who take jobs in personal services, construction, or trade (e.g., restaurants)—most of them from Latin America. Many of the

Americans who work in the underground economy do so in response to disruptions and uncertainties in the labor market, as well as underemployment. People who fear future lay-offs take opportunities that they happen upon. By definition, they are part of the contingent labor force.

EMPLOYMENT AND STRUCTURAL CHANGE IN THE U.S. ECONOMY

Economic activities can be grouped in many ways. The simple, most common division breaks the economy into three broad sectors: 1) a primary sector, the largest components of which are agriculture and mining; 2) secondary industries, manufacturing and construction; and 3) a tertiary or service sector. (This is the conventional use of the term tertiary, not the sense used in this report—see below.) The outputs of the primary industries, extracted in some way from the natural world (food, timber, iron ore), provide inputs to secondary industries (food processing, housing construction, steelmaking). The service sector, in essence, takes in everything that is left—including, under most classification schemes, government.

This conventional threefold classification reveals little concerning employment in the services. Thus, as explained in chapter 1, this report subdivides the services into knowledge-based and tertiary categories—reserving the term tertiary for the subset of traditional service industries and occupations (table 6) such as retailing and personal services. Throughout the remainder of this chapter, tertiary will, as elsewhere in the report, refer only to that subset of services.

The Shift to Services

As economies develop, employment in agriculture and mining shrinks, people find jobs in manufacturing, and, somewhat later, in the services. Post-industrial economies, those in which the service sector has come to dominate, emerged after World War II. Table 32 provides a summary picture of U.S. employment patterns over the period 1975-85, based on a fivefold classification that further subdivides both manufacturing and the services, identifying knowledge-based jobs and sectors in each.[2] The breakdown is inevitably somewhat arbitrary. Many of the jobs in traditional industries are highly skilled and thus knowledge-intensive. On the other hand, large numbers of people working in knowledge-based services like health care have routine, even menial, jobs. Nonetheless, this classification helps delineate important shifts in the structure of U.S. employment.

Since 1980, employment in the traditional industries (Sector II in table 32, manufacturing and construction) has declined both relatively and absolutely. Net new jobs have been created in both the knowledge-based and tertiary services, along with knowledge-intensive manufacturing (Sector III). Services in total now employ more than 70 percent of the U.S. labor force, with high continuing rates of growth. Sector IV (knowledge-based services) grew by one-third over the period 1975-85, as did tertiary service employment. Jobs in Sector III (knowledge-intensive manufacturing) grew by more than 40 percent.

Explanations for the relative growth of services employment would take the analysis well beyond the bounds of this assessment. Cer-

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[2] The classification in table 32, along with much other material in chs. 7 and 8, is based on "International Competition in the Service Industries: Impacts of Technological Change and International Trade on U.S. Employment," prepared for OTA by E. Appelbaum, P.S. Albin, R. Koppel, and F. Hormozi under contract No. 533-5560.

Because of the need to base table 32 on Bureau of Labor Statistics (BLS) categories, it does not correspond directly to the classifications in table 6. Moreover, at various points, ch. 7 uses data from the Bureau of the Census in the Department of Commerce as well as from BLS (part of the Department of Labor). Census and BLS do not always use comparable categories and procedures. Largely because of this, it has not been practical to rigorously maintain the distinction between knowledge-based and tertiary services at all places in the chapter. Doing so would have meant sacrificing much of the statistical detail available in the databases of one or the other of the agencies.

Table 32.—U.S. Employment by Sector

	Annual average (thousands)		
	1975	1980	1985
Sector I, agriculture and mining	**4,319**	**4,472**	**4,262**
Sector II, traditional industries	**18,500**	**21,121**	**19,540**
Construction	3,457	4,469	4,662
Manufacturing excluding information machines (below) and printing/publishing equipment	15,043	16,652	14,879
Sector III, knowledge-intensive manufacturing	**2,225**	**2,927**	**3,126**
Electrical, electronic, and communication equipment excluding household appliances and electric lighting	1,426	1,744	1,865
Instruments and related equipment	489	711	724
Office and computing machines	284	431	506
Printing/publishing equipment	26	41	31
Sector IV, knowledge-based services	**28,582**	**33,794**	**38,101**
Education[a]	7,448	7,650	8,371
Health	5,393[b]	6,287	7,583
Communications media	1,434	1,687	1,877
Telecommunications (mainly telephone and postal service)	1,710	1,739	1,833
Business services	1,629	2,523	3,732
Computer and data processing services	143	293	1,819
Other business services	1,486	2,230	3,275
Professional services (legal, engineering, accounting, etc.)	743	1,353	1,819
Financial services (banking, insurance, real estate)	4,223	5,162	5,924
Government not included elsewhere	6,002	7,393	6,962
Sector V, tertiary services	**27,257**	**32,407**	**36,042**
Transportation and public utilities[c]	3,888	4,397	4,477
Wholesale trade	4,177	5,275	5,769
Retail trade	12,771	15,292	17,425
Lodging	979	1,071	1,368
Personal services	835	931	1,125
Auto and other repair services	656	889	1,066
Tertiary business services	477	615	836
Other tertiary services	3,474	3,937	3,976

[a] Federal education employment included under government.
[b] OTA estimate.
[c] State transportation employment included under government.
NOTE: Totals may not add due to rounding.

SOURCES: *Supplement to Employment and Earnings* (Washington, DC: Department of Labor, Bureau of Labor Statistics, July 1983 and June 1986); *Employment and Earnings Bulletin*, 1979, pp. 1311-1312; except for farming, forestry, and fishing from "Projections to 1995," Bulletin No. 2253 D-2, April 1986, Department of Labor, Bureau of Labor Statistics.

tainly, relative productivity trends would be part of the story. Measures of productivity in the services are poor—particularly on the output side, where the qualitative characteristics of services like banking have changed dramatically over the past two decades. But, despite the flaws in the data, it does appear that productivity in the services has increased less rapidly than in manufacturing.[3] Low productivity growth coupled with expanding output means higher rates of job creation.

In many of the knowledge-based services, automation has already proceeded through several generations of computer-based methods and work organization (ch. 8). Output has risen in sectors like banking (in terms of such measures as transactions processed) without parallel increases in employment; indeed, it has been said that providing today's banking services using 1950s technology would require half the U.S. labor force. The continuing spread of automation through the services points to a major question: Will new technologies deployed in service industries eventually lead to productivity improvement so rapid that employment growth slows relative to output? If so, rates of job creation in the services could drop. Slower job creation would aggravate the unemployment and underemployment already endemic in the United States.

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[3] See, for example, "The Service Economy: Opportunity, Threat or Myth?" Proceedings of a Workshop on Structural Change, Department of Commerce, Oct. 22, 1985, especially H.K. Stokes, Jr., "The Shift to Services: Does It Threaten Long-Run Productivity Growth," pp. 105-116.

Is this scenario likely? As in manufacturing, domestic employment in the services will necessarily depend on trends in both productivity and output. Output will depend in part on patterns of international trade and competition—the effects of which are largely indirect. In part because of these complexities, OTA cannot definitively answer the questions posed above. Some indicators do suggest that the services are poised for rapid productivity growth, with a marked slowdown in rates of job creation, particularly for clerical workers.[4] One implication, consistent with much of OTA's past work, is plain. The United States will face continuing adjustment problems. Displacement will be a fact of working life for many Americans. The policy implications are also plain. The United States will need to maintain flexible labor markets and continuing public and private sector commitments to training, retraining, and reemployment.[5] Chapter 10 deals with these issues of human resources policy.

Table 33 outlines the current distribution of occupations in the U.S. economy. The table shows that the vast majority of professionals, managers, and technicians—as well as salespeople and clerical workers—work in the service industries. (In terms of occupational rather than industry classifications, most professionals fill service jobs by definition.) Craft workers, machine operators, and laborers, on the other hand, find work primarily in manufacturing.

Table 33.—Sectoral Distribution by Occupation in the U.S. Economy, 1986[a]

	Percentage of those in a given occupation employed:	
	In service industries	In nonservice industries
Professionals	86%	14%
Managers	73	27
Technicians	73	27
Salespeople	94	6
Craft workers	36	64
Operatives, fabricators, laborers	40	60
Clerical workers and administrative support	82	18
Service occupations	96	4
Other, primarily agricultural	16	84

[a] Based on data for April

SOURCE: Calculated from data in *Employment and Earnings*, table A-25, p. 32, May 1986.

Because managerial and professional jobs pay well, the occupational distribution outlined in table 33 raises the average level of compensation in the services compared to manufacturing. At the same time, the disparity between the wages earned by managers and professionals (as well as some salespeople) and the wages of those in the "service occupations" contributes to the two-tiered nature of compensation in the U.S. labor market (discussed below). Rapid growth in services enhances this split between a small group of well-paid people at the top of the pyramid, and a very much larger group with low wages at the bottom. Differing mobility patterns also contribute; those in occupations near the bottom of the pyramid have limited prospects for moving up, although making frequent lateral moves (turnover is high in unattractive jobs). Managers and professionals, in contrast, normally move steadily upward in terms of pay over the course of their careers.

Job Creation

Since the Second World War, the U.S. labor force has grown steadily, nearly doubling between 1952 and 1985. As figure 44 shows, the increase has been especially rapid since the

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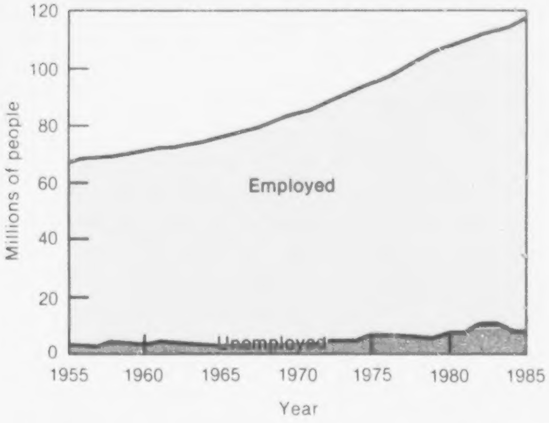
[4] *Automation of America's Offices* (Washington, DC: Office of Technology Assessment, December 1985); also W. Leontief and F. Duchin, *The Future Impact of Automation on Workers* (New York: Oxford University Press, 1986). Leontief and Duchin suggest that clerical jobs could drop from about 17 to 18 percent of U.S. employment to as low as 12 percent by 2000 (p. 14).

[5] *Technology and Structural Unemployment: Reemploying Displaced Adults* (Washington, DC: Office of Technology Assessment, February 1986).

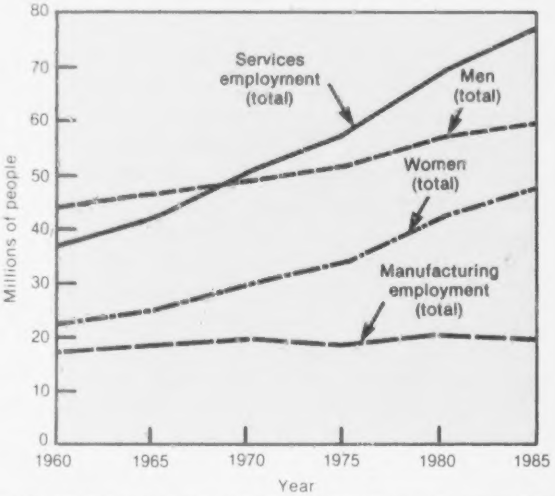
As one example of the magnitude of these displacement problems, note the situation of the production workers who lost their jobs when International Harvester's plant in Fort Wayne, IN, closed in 1983. On the average, these men and women remained unemployed for 39 weeks. When they found work, their new jobs paid 20 percent less. Average family assets dropped by more than $6,000. See "The New Job After the Plant Closed Meant Considerably Less Pay," *Wall Street Journal*, Oct. 22, 1985, p. 1. Moreover, both clerical and managerial employees took pay cuts greater than those of the displaced production workers.

Figure 44.—Growth of the U.S. Labor Force



SOURCE: Bureau of Labor Statistics, *Employment and Earnings*, October 1986, p. 7.

Figure 45.—U.S. Employment by Industry and Sex



NOTE: Services employment includes construction and government. The breakdowns by sex and by sector come from different series and may not be strictly comparable.

SOURCE: Bureau of Labor Statistics, *Employment and Earnings*, various issues.

mid-1960s, as the postwar baby-boom generation entered the labor market. With the labor force growing faster than the number of jobs, unemployment has risen. Figure 45 breaks down the increase in employment since 1960 by industry and sex. Large numbers of women have joined the labor force. Manufacturing employment has changed little, but employment in service industries—in 1960 already double that in manufacturing—has continued to rise.

Competition and Structural Change

In U.S. manufacturing, structural shifts going back in many cases to the 1960s have had far-reaching consequences for employment. Industries like steel, automobiles, and apparel have been hit hard by import competition. Competitive pressures (along with the strength of the dollar during the first half of the 1980s) drove American firms to shift some employment overseas, move to low-cost locations within the United States, and to automate.

In the services as well as in manufacturing, changes in product design and in production processes affect the overall number of jobs available, as well as demand by occupations and the characteristics of jobs within a given industry or occupation. New products—money market mutual funds, aircraft parts made from fiber-reinforced composites rather than sheet metal—may mean more jobs or fewer jobs, as well as quite different skill requirements. The work done by medical technicians has changed a great deal since the 1960s, largely because of the introduction of computer-based laboratory equipment.

Competition forces firms to automate and reorganize their production processes; the next chapter shows how American insurance companies have turned to computer-based automation, not only in back-office paper processing, but for claims adustments in the field. In insurance, domestic competition has been the principal spur. In industries where international competition has been a factor, change has often been more rapid and more fundamental: companies may not only redesign their products and production processes, they may move production offshore, seeking locations with lower costs—notably for labor. While domestic competition can also lead to offshore production—this was the case in the 1960s when American semiconductor firms began moving abroad (mostly to Asia)—pressures from imports hasten things along.

Domestic and international competition also contribute to geographic shifts within the United States. Manufacturing companies have moved South and West in search of labor markets with lower wages and fewer labor unions. Some service companies have followed: Citicorp tranferred its credit card operations from Long Island to Sioux Falls, South Dakota in the early 1980s; American Express now processes travelers checks in Salt Lake City rather than Manhattan. Jobs like data entry, provided exceptions to standard procedures are rare, can be handled remotely with little or no productivity loss.

Some of this sort of work has also moved offshore, although the absolute numbers remain small.[6] Technology that would facilitate the export of office jobs continues to emerge. Although the clarity of facsimile transmissions remains a problem, and two-way satellite links expensive, low transportation costs and low wages make it cost-effective for some U.S. firms to ship paper to the Caribbean and return magnetic disks or tape. Continuing technical advances promise to make offshore office work more practical. But before many of these jobs actually move abroad, it seems likely that more highly automated technologies (paperless transactions) will largely replace data entry and other routine input-output jobs. While offshore office work will, therefore, probably not cut severely into U.S. job opportunities, continuing multinational expansion and decentralization by large American corporations will see more of the work now done at headquarters dispersed to locations abroad.

The Dynamics of Job Creation

From 1972 to 1984, civilian employment in the United States rose by 20.8 million (table 34)—a figure equal to jobs created minus jobs destroyed, and thus at least hinting at the associated structural shifts and displacements. About 8 percent of U.S. jobs disappear each year, meaning that an equivalent number must be created just to stay even. *Net* job creation has depended almost entirely on expansion in the services; since 1979, manufacturing employment has shrunk, so that the services, in effect, have created more than 100 percent of net new jobs. Although jobs have disappeared in manufacturing slightly faster than they have been created, rates of creation and destruction vary widely across sectors in U.S. manufacturing. Knowledge-intensive or high-technology manufacturing has continued, in general, to create jobs (table 32). Other manufacturing sectors have declined, some very rapidly.

Some portion of job creation in services may be a bit illusory, because manufacturing firms

Table 34.—U.S. Job Creation by Industry, 1972-84

Industry[a]	Net new jobs (thousands)	Percentage of net new jobs	Employment share 1972	Employment share 1984
Total	20,785	100.0%	100.0%	100.0%
Mining	346	1.7	0.9	1.0
Construction	456	2.2	5.3	4.6
Manufacturing	261	1.3	26.0	20.6
Transportation/public utilities	657	3.2	6.2	5.5
Trade	6,185	29.8	21.6	23.4
Finance, insurance, and real estate (FIRE)	1,774	8.5	5.3	6.0
Other services	8,485	40.8	16.7	22.0
Government	2,621	12.6	18.1	16.9

[a] One-digit Standard Industrial Classification (SIC) basis.

SOURCE: *Employment and Earnings*, May 1986, table B-1, p. 45.

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[6] See *Automation of America's Offices*, op. cit., ch. 8, "Off-shore Office Work;" also B. Stokes, "Beaming Jobs Overseas," *National Journal*, July 27, 1985, p. 1726. At present, a few thousand workers—perhaps 10,000 at most—in several of the Caribbean countries and Mexico, as well as Singapore, South Korea, and India, perform coupon sorting, data entry, and routine data processing for as many as a hundred American businesses. Some computer programming is done remotely, as well.

have been hiring service firms to take on tasks once performed by their own employees (maintenance, plant security, food service, engineering). It remains the case, however, that the United States has in the net created jobs more consistently than other major Western economies. Since the middle to late 1960s, unemployment rates have been gradually but steadily rising throughout the advanced industrial nations, not excluding Japan.[7] While many of the new service jobs in the United States have been low in pay and status, as discussed below, at least the U.S. economy has been creating them. Most of the European economies have not.

The dominance of the services in U.S. job creation—in a context of declining manufacturing employment—raises troubling questions. How do these jobs compare with work in manufacturing in terms of skill requirements and pay? In terms of opportunities for advancement? The following sections address such questions, utilizing a series of industry and occupational profiles.[8] The industry profiles compare major service and non-service sectors in terms of the kinds of jobs created and the workers and skills in greatest demand. The occupational profiles compare the demand for labor as a function of skills and credentials across industries.

Industrial Profile of Job Creation

U.S. manufacturing jobs reached a peak and began to decline over the 1972-84 period. Although there were more manufacturing jobs in 1984 than in 1972, the relative share of manufacturing dropped by more than 5 percentage points, as shown in table 34. Manufacturing employment will undoubtedly continue to shrink as a fraction of the total. In contrast, almost all the service industries have experienced substantial net job growth. Of nearly 21 million new jobs between 1972 and 1984, over 16 million (79 percent) were created in wholesale and retail trade, FIRE (finance, insurance, and real estate), and "other services" (table 34)—with roughly one in three in a food- or health-related enterprise.

Table 35 subdivides the industries listed in the preceding table, showing large percentage increases in employment in segments of wholesale trade (primarily durable goods), and in retail trade (mostly eating and drinking establishments—which, given a large initial base, created 2½ million jobs). Almost all segments of the FIRE industries saw rapid employment increases, as did "other services." In percentage terms, expansion was most rapid in computer-related services (a 325 percent rise, by far the highest of any sector), followed by legal and social services. But in total jobs created, again because of the large initial base, health services exceeds even eating and drinking establishments. (Note that table 35, restricted to service industries showing 30 percent growth or more over the period 1972-84, excludes some relatively large sectors that created many new jobs although expanding at lower rates.)

Table 36 lists demographic and occupational characteristics as revealed by the 1980 census. While the statistics themselves are now rather dated, the 10-year census of population provides a wealth of information not otherwise available. The table shows that manufacturing employees, on average, earned substantially more than those in many of the rapidly-growing service industries; median annual (full-time) earnings were 25 percent greater in manufacturing than in "other services," despite the high annual earnings in the professional service categories.

Such differences have persisted; as of mid-1986, average hourly pay in U.S. manufacturing was $9.70 (excluding benefits), compared with $8.10 in the service sector (20 percent lower). Service workers earn less in part because more of them are women, and also because they tend to be younger. According to the table, more than two-thirds of the Ameri-

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[7] *International Competitiveness in Electronics* (Washington, DC: Office of Technology Assessment, November 1983), p. 345.

[8] These profiles are based on "International Competition in Service Industries: Labor Market and Employment Issues," prepared for OTA by J.A. Orr under contract No. 533-4845. Much of the analysis is based on trends revealed in the 1980 census, which provides far more information than is available between the 10-year censuses.

Table 35.—High-Growth Service Industries, 1972-84[a]

Industry	Net new jobs (thousands)	Growth over the period 1972-84
Wholesale trade:		
Machinery, equipment, and supplies	535	62%
Electrical goods	138	42
Groceries	184	35
Retail trade:		
Eating and drinking establishments	2,521	70%
Food stores	840	30
Finance, insurance, and real estate FIRE:		
Commercial and savings banks	512	50%
Real estate	339	46
Insurance agents, brokers	205	68
Savings and loans	193	61
Securities and commodities brokers and dealers	141	60
Medical and health insurance	53	35
Other services:		
Business services:		
Personnel supply[b]	613	82%
Computer and data processing	364	325
Services to buildings	279	53
Automotive repair, garages	284	36
Amusement and recreation	445	89
Hotels and lodging	418	64
Professional services:		
Health	2,677	79
Social	667	134
Legal	387	144
Engineering and architectural	283	83
Accounting, auditing, and bookkeeping	174	85

[a] Two- and three-digit Standard Industrial Classifications.
[b] Including temporary help services and employment agencies.

SOURCE: Bureau of Labor Statistics.

cans working in manufacturing industries were men. In contrast, 45 percent in trade were women, and more than 60 percent in "other services." Everything else the same (and often when it is not), men continue to earn more than women. Furthermore, the average manufacturing worker can expect more pay simply on the basis of age. The table shows those with jobs in trade to have a median age of 32, compared with 36 in manufacturing.

Service workers have more education, on the average, than manufacturing employees; at equivalent levels of education, they make less. Especially among the younger workers in the new service labor force, educational levels are higher simply because more Americans now finish high school; only in personal services is the percentage of high school graduates lower than in manufacturing—60 percent compared with 70 percent. Of course, some of the new jobs being created in the services demand more education and better skills (or at least different skills—ch. 8), while a few of the service sectors listed in table 36 employ large numbers of professionals. Those with college degrees are most heavily represented in business and professional services, and in the FIRE industries.

Within the FIRE industries, commercial and savings banks added more than half a million jobs between 1972 and 1984 (table 35), with savings and loans contributing another 193,000; together, real estate and insurance accounted for 700,000 (including several slowly growing subsectors omitted from table 35). As in trade, women fill many of these jobs, but the average levels of education are considerably higher in the FIRE industries—90 percent high school graduates compared with 70 percent in trade, and nearly a quarter with college degrees. At the same time, FIRE employees are considerably older, on the average, than those in trade. FIRE jobs tend to be full-time, but annual earnings are relatively low. Indeed, the coupling of relatively high educational levels and relatively low pay sets the FIRE industries apart from other sectors in both the services and manufacturing. With exceptions such as managers, underwriters, and brokers, many of the jobs in these industries have been held by women who are the second wage earners in the family (note that the percentage of heads of households found in banking is the lowest of all industries listed in table 36). Chapter 8 discusses jobs in banking and insurance from the perspective of changes in work organization, illustrating some of the other reasons for this combination of high education and low pay.

Service employees are less likely to work full time than those in manufacturing. This depresses annual earnings, and usually means much lower fringe benefits. While more than 70 percent of manufacturing workers had full-time jobs in 1980, half of all employees in the trade sector worked part time. In "other services," full-time employment predominates only in the more skilled jobs (computer and data

Table 36.—Work Force Characteristics in Manufacturing and Selected Nonmanufacturing Industries, 1980

Industry	Percent full time[a]	Median earnings, all[b]	Median earnings, full-time[b]	Percent male	Median age	Percent nonwhite	Percent foreign born	Percent head of household	Percent high school graduates	Percent college graduates
Total nonagricultural	59.0%	$10,600	$14,200	56.5%	35.5	14.0%	6.7%	55.9%	76.4%	18.9%
Manufacturing	70.9	13,000	15,200	68.0	36.7	14.6	8.3	64.4	69.9	11.9
Transportation, communications, and public utilities	73.5	16,000	18,200	75.5	37.2	15.3	4.7	72.1	79.4	10.9
Trade	50.8	7,600	12,100	54.1	31.9	10.8	6.7	46.5	70.4	9.9
FIRE	67.5	10,100	12,200	41.8	35.0	11.2	6.7	50.3	90.3	23.1
Banking	68.1	8,900	10,500	29.1	32.1	14.0	7.9	38.5	91.7	17.8
Security and commodity brokerage	70.3	14,500	17,600	60.6	36.0	16.1	6.8	46.5	82.2	33.0
Insurance	73.2	11,300	13,200	43.3	34.8	10.6	5.2	53.2	93.2	25.5
Other services	47.4	8,790	12,100	38.7	36.0	16.1	6.8	46.5	82.2	33.0
Personal	39.0	4,880	8,220	29.5	38.8	25.0	11.0	42.1	60.0	6.0
Nonpersonal:										
Business	57.1	10,200	15,000	57.1	34.8	14.6	7.4	57.0	83.6	28.3
Computer and data processing	72.7	14,600	17,800	60.2	32.1	11.6	6.8	61.0	95.0	48.0
Repair	59.9	9,620	12,400	74.5	33.9	10.9	7.3	62.1	71.2	9.7
Entertainment	37.7	6,650	11,700	59.2	30.3	11.7	6.7	47.1	72.2	17.2
Professional	46.9	9,360	12,300	33.5	36.3	15.6	6.0	44.5	87.1	40.9
Engineering and architectural	73.5	16,700	19,600	79.1	35.2	8.4	10.1	72.5	94.8	48.0
Accounting, auditing, and bookkeeping	63.1	12,100	16,600	51.7	34.1	5.1	4.9	55.7	95.8	51.0

[a] Full-time workers are defined as those working at least 50 weeks in 1979, and at least 35 hours per week.

[b] Does not include fringe benefits.

SOURCE: 1980 Census of Population, Public Use Sample.

processing, repair services, some subsectors of professional services). Finally, relatively fewer non-manufacturing employees belong to labor unions. As table 37 shows, about a quarter of American manufacturing workers continue to be covered by collective bargaining agreements, compared with less than 10 percent in many of the service industries. (Differences in factors such as value-added also affect relative wage levels across industries.)

Much more so than in blue-collar manufacturing jobs—where people can expect to advance with seniority, particularly in unionized industries—career prospects for those who enter the services depend on educational background and credentials. Of the high proportion of young and/or less educated employees in entry-level positions, particularly in the trade sector, some take jobs during interruptions in schooling or on a part-time basis while students. For these people, high rates of job creation in the services mean easy entry into the labor market and widespread opportunities for initial work experience. Many go on to better-paying jobs in entirely different industries—jobs with good prospects for upward mobility—when they complete their schooling.

Those with less education and/or poor skills face much dimmer career prospects. The jobs they can get will be less likely to prove the first rung on a career ladder. Although they may learn and advance somewhat with on-the-job experience, fewer career ladders seem to exist in the services today than in the past; as discussed below, companies now tend to hire in entry-level college graduates, rather than filling lower level administrative and supervisory jobs with those moving upward in the ranks. To get such jobs—and get a foot on the ladder—may mean a 2-year degree, or in some cases specialized training in fields like business.

The data in table 36, then, hold few surprises. Higher incomes correlate with age, with union membership, and, given some exceptions, with levels of education. White males get the best jobs in both manufacturing and the services. Average wages in the services lag behind those in manufacturing except in industries with high proportions of professionals. The accounting, auditing, and bookkeeping sector, for example, shows relatively high median earnings—$16,600 for full-time employees in 1980 (table 36). This is greater than the median for manufacturing employees ($15,200) or in banking (only $10,500),

Table 37.—Union Representation by Industry

Industry	Percentage of wage and salary workers covered by collective bargaining agreements	
	1980[a]	1984[b]
All (including government)	23.0%	19.1%
Government	35.9	35.9
Private sector	20.1	15.6
Service producing	13.5	10.6
Transportation, communications, and public utilities	48.4	39.6
Wholesale and retail trade	0.1	8.2
Finance, insurance, and real estate (FIRE)	3.2	2.7
Other services	8.9	7.2
Goods producing[c]	30.5	24.5
Mining	32.0	17.9
Construction	30.9	24.3
Manufacturing	32.3	26.5
Durable goods	34.8	28.0
Nondurable goods	28.5	24.2

[a] Percentages for May.
[b] Averages for 12-month period ending September 1984.
[c] Includes agriculture, and forestry and fisheries, in addition to those listed separately.

SOURCE: L.T. Adams, "Changing Employment Patterns of Organized Workers," *Monthly Labor Review*, February 1985, p. 26.

even though women make up nearly half of all accounting, auditing, and bookkeeping employees. But over half of those in this sector have college degrees—indeed, the percentage is the highest of all industries listed in the table.

Occupational Profile of Job Creation[9]

More than half of all new jobs created from 1970 to 1980 fall in one of two occupational categories—both relatively low-skilled and low-paid:

1. Sales/support, including sales clerks, cashiers, and secretaries—which accounted for 36 percent of new jobs over the 1970-80 period;
2. "Service" occupations such as security guards, custodians, food service workers, and nurses aides—accounting for another 19 percent of all new jobs.

Rapid growth in food service and other retail trade establishments, and in health care drove job creation in both sets of occupations. But job creation was also rapid at the high-skill, high-pay end of the spectrum, with professional and managerial/administrative occupations comprising more than 26 percent of all newly created jobs over this same period—about half as many jobs in total as in sales/support and "services." Note that some of the people working in service *occupations* hold jobs in the manufacturing sector of the economy. Nurses aides, for instance, may find jobs either in the services or in manufacturing (although many more work in hospitals than factories).

While service occupations have grown, traditional manufacturing jobs like assembler and machine operator have declined, and not only in absolute numbers—on the manufacturing side of the economy, the fraction of production employees has dropped. Particularly in knowledge-intensive sectors like computers or microelectronics, companies are hiring increasing numbers of skilled blue-collar and white-collar employees. Nonetheless, manufacturing firms in both durable and nondurable goods industries still employ large numbers of Americans in occupational categories such as machine operator and production craft worker; together, these two groups accounted for over half of all employment in U.S. manufacturing at the time of the 1980 census.

In addition to the professionals, skilled white-collar workers, and low-skilled clericals that banks and insurance companies have always depended on, these companies—like many other service firms—increasingly seek employees with specialized technical skills such as computer programming. According to the 1980 census, computer-related occupations made up 3.6 percent of employment in banking, and 4 percent in the insurance industry, compared with 3.3 percent in durable goods manufacturing and only 1.0 percent in non-durables.[10] In total, more than 80 percent of insurance industry employees, and 68 percent of those in banking, filled jobs that can be classified as technical/professional (including such traditional occupations as loan officer, underwriter, and claims adjuster, but excluding managers) or sales/support. Another 14 percent in insurance and 26 percent in banking held managerial jobs—compared with only 8.6 percent in manufacturing.

Within the technical/professional categories, of course, the range in skills is vast: some but not all of these people—e.g., data-entry clerks—have semi-skilled jobs analogous to machine operators and assemblers. Industries like legal services employ, not surprisingly, 42 percent professionals. Business and repair services show the most varied occupational mix: roughly 20 percent mechanics and repairers, 23 percent production/craft workers, 30 percent technical and sales/support employees, and 15 percent managers. Mechanics and repairers, as an occupation, show up in a broad range of industries, as do occupations related to transportation and materials handling—important in manufacturing (about 10 percent of all manufacturing jobs) and in trade (9 percent).

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[9] Otherwise unattributed data in this section comes from "International Competition in Service Industries: Labor Market and Employment Issues," op. cit., table II.3, and is based on the 1980 Census Public Use Sample.

[10] Business and repair services showed the highest fraction of computer-related occupations—5.6 percent. Other service industries, notably the personal services, though large in absolute size, create few such jobs (0.1 percent). One percent of all jobs in trade and the FIRE industries were computer-related, and 0.9 percent in professional services. All these figures, which come from the Public Use Sample of the 1980 Census of Population, have no doubt increased over the intervening years. At the time of the census, the overall figure for computer-related jobs, excluding agriculture, was 1.5 percent.

Labor force characteristics by occupation—outlined in table 38, which parallels the profile by industries in table 36—illustrate the typical differences between manufacturing and service jobs from a somewhat different perspective. Manufacturing occupations such as operator/assembler and production/craft worker show above-average earnings and below-average educational levels. The high-growth sales/support and service occupations, in contrast, have the lowest average earnings of any major occupational category. While 85 percent of sales/support workers have a high school education, compared with 57 percent for operators/assemblers, the latter show median annual earnings higher by $1,100.

In general, people in a given occupational group make more money if they work in a manufacturing industry than in a service industry. As table 33 indicated, many of those in service *occupations* have jobs in industries classed in the manufacturing sector, and vice versa. Eighteen percent of all clerical workers—a service occupation—work for manufacturing firms. Clerks employed in manufacturing have about the same education, on average, as clericals in other industries—but earn more. Likewise, a typical 35-year-old in a sales/support occupation earned $18,000 in 1980 if he or she worked in the manufacturing sector, but only $13,500 in trade or FIRE (and still less in other sectors—median earnings came to only $11,000), again despite similar educational levels. Managers in manufacturing industries earn more than managers in the services, all other things the same. Of course, other things are not always the same. People in service occupations working for manufacturing companies tend to have other characteristics associated with higher incomes—they are older, more likely to be men, and more likely to work full time. Put another way, they have different job histories, reflecting other characteristic differences between manufacturing and the services.

Although the faster relative growth of the service industries has been the primary reason for the shift toward service occupations in the U.S. labor force, growth of service functions and service jobs *within* manufacturing has also been important. The proportion of nonproduction workers in many manufacturing companies has been rising. At the same time, American manufacturers are also making greater use of outside contractors and people who work for temporary help service firms—sometimes in production, but more commonly to fill jobs ranging from engineering and drafting to plant security and cafeteria work—as discussed in a later section.

MOBILITY

The kinds of jobs being created and their distribution within the economy help determine worker mobility, both vertically (upward within a firm or industry) and laterally (e.g., from manufacturing to the services). Overall, *employment in service industries seems to offer fewer opportunities for upward mobility*, though horizontal mobility may be greater than in manufacturing.

Manufacturing work, particularly in unionized industries, offered attractive opportunities for many Americans in the years following the Second World War. Collective bargaining agreements meant, not only substantially more pay than in non-union companies, but a framework within which on-the-job training and experience combined with job tenure and seniority rules to provide upward ladders by which em-

Table 38.—Characteristics of Workers in Selected Occupations, 1980

Occupation	Percent full time[a]	Median full-time earnings[b]	Percent male	Median age	Percent nonwhite	Percent foreign born	Percent head of household	Percent high school gradutes	Percent college graduates
Total nonagricultural	59.0%	$14,200	56.5%	35.5	14.0%	6.7%	55.9%	76.4%	18.9%
Managerial	79.6	19,300	69.7	39.8	7.7	6.0	72.7	91.1	38.5
Professional	53.1	18,400	50.7	36.3	10.7	6.5	58.5	96.7	68.8
Engineers	85.6	24,300	95.3	38.8	7.8	9.7	88.5	97.9	68.8
Mathematics and computer science	86.5	22,100	74.0	34.9	9.7	6.9	76.4	98.8	58.5
Health diagnosticians	58.7	16,800	33.8	36.5	12.0	9.8	49.6	97.7	55.9
Teachers, librarians	29.9	15,300	34.1	36.2	11.8	4.1	46.1	97.5	81.7
Computer systems analysts	78.6	22,500	77.7	34.4	9.4	7.0	78.2	98.1	58.0
Technicians	67.2	14,900	56.1	32.4	13.2	6.7	58.8	93.0	25.1
Computer programmers	75.8	18,200	69.6	30.6	11.3	7.4	67.3	97.8	47.9
Sales/support	57.7	11,000	33.6	34.7	11.5	5.3	43.0	85.0	18.0
Service	39.2	9,350	40.7	34.0	22.7	8.3	41.0	59.9	4.8
Food preparation	24.8	7,200	33.5	26.4	17.2	9.3	27.6	53.6	3.3
Health services	46.4	8,080	11.8	33.2	27.7	7.2	31.6	69.2	5.1
Personal	32.9	8,230	21.9	34.9	17.6	7.8	32.9	73.5	7.2
Cleaning and buiding	48.6	9,820	64.7	41.1	30.5	9.7	54.8	45.9	2.4
Operators/assemblers	62.3	12,100	59.7	35.2	20.3	10.4	56.0	57.2	2.3
Production/craft	70.0	16,700	92.1	36.8	10.7	6.7	78.9	69.2	5.4
Transport/material movers	54.6	13,800	85.9	32.7	18.7	5.6	62.5	56.0	2.6
Mechanics/repairers	75.6	14,700	96.6	35.5	9.9	5.4	80.6	70.0	3.1

[a] Full-time workers are defined as those working at least 50 weeks in 1979, and at least 35 hours per week.

[b] Does not include fringe benefits.

SOURCE: 1980 Census of Population, Public Use Sample.

ployees could expect to advance in terms of skills, responsibility, and income. A broad spectrum of skilled occupations separated unskilled or semi-skilled laborers and assembly workers from college-trained managers and supervisors—a spectrum including craft workers (millwrights, pipefitters, tool setters, machine repairers), technicians and draftsmen, and, in many cases, foremen risen from the ranks. After the war, those who entered rapidly expanding capital and consumer goods industries could expect job security, steadily rising income, and relative affluence—prospects that have vanished over the last 10 years, notably in industries like steel and automobiles, as a result of international competition and structural change in the U.S. economy.

It is no surprise that few manufacturing workers have moved laterally into the services (less than 500,000 over the period 1979-84).[11] Because manufacturing workers can earn considerably more than those in service occupations with the same level of education, people with well-paying manufacturing jobs hold on to them whenever possible. And, because a good deal of the decline in U.S. manufacturing employment has come through attrition (retirement and voluntary quits), the number of manufacturing workers looking for jobs in the services tends to be smaller than might be expected based on the publicity given mass layoffs and plant closings in depressed industries.

But what about the career prospects of the younger, more educated service workers profiled in the 1980 census (tables 36 and 38)? As the service-based U.S. economy continues to mature, will levels of pay rise so that these people will experience job histories in terms of income and upward mobility comparable to their forerunners in manufacturing? Probably not. New entrants into the labor force with a high school education (or less) seem unlikely to have the opportunities that those with similar backgrounds could expect a generation ago. The manufacturing jobs these people could enter are vanishing. The service jobs for which today's high school graduates can qualify will not offer the career prospects of the manufacturing jobs available 30 years ago.

Of course, job ladders do exist in the services. But many examples, including several summarized later in this section, and in chapter 8, suggest that prospects for younger Americans currently entering the service industries will not be as good as for their parents who went to work in factories.[12] Vertical mobility may be less, in part because service companies tend to hire people with specialized skills (selling) or educational backgrounds (computer programming) for many of their openings; where on-the-job learning can still lead to advancement, many career ladders are nonetheless capped at relatively low levels. Horizontal movement will be easier, particularly for nonunion workers with no seniority to give up—but moving, say, from a clerical job in retailing to a similar job in the insurance industry may not lead to much of an increment in pay, or to new opportunities.

People in some service jobs do develop specialized occupational skills that are easily transportable across industry boundaries. These skills may begin with relatively formal education and training (accounting). In other cases, they may be developed on the job (computer graphics)—although on-the-job skill development has generally been more important in manufacturing than the services, if only because manufacturing workers have not been as well-educated to begin with. To the extent that commonality of skill requirements across the services (including social skills) grows, lateral mobility will increase; it has probably always been easier to go from selling shoes to selling insurance than from making shoes to making steel—certainly easier to do so without moving to another city or State. Of course, many skilled and craft workers in manufacturing—toolmakers, electricians—have always had know-how that could be readily transferred across industry boundaries.

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[11] "Labor Mobility and Structural Change in Pittsburgh, 1977-82," op. cit.

[12] See, for example, "Labor Mobility and Structural Change in Pittsburgh, 1977-82," op. cit.; "Testimony of Dr. Eileen Appelbaum, Temple University, Philadelphia, PA 19122, The Shrinking Middle: Evidence from the Insurance Industry," *Service Industries: The Future Shape of the American Economy*, hearings, Subcommittee on Economic Stabilization, Committee on Banking, Finance and Urban Affairs, House of Representatives, June 8, 12, 14, and 28, 1984 (Washington, DC: U.S. Government Printing Office, 1984), p. 627.

While lateral mobility may be on the rise, giving service workers greater flexibility than some of their counterparts in manufacturing, upward channels in many service firms have been cut off. Partly because companies now hire college-trained people for jobs once filled through promotion, and partly because changes in work organization (largely computer applications) have stripped away some of the rungs on career ladders, many service workers have little opportunity for advancement. Both factors—structural/organization change, and technological change—have contributed to the development of two-tiered employment patterns in the United States. Boxes X and Y illustrate.

In industries as different as retailing and telecommunications (boxes X and Y), new patterns of hiring fence off supervisory and managerial jobs from most of the work force. In both cases—as in others described in the next chapter (banking, insurance)—deregulation, new competition, and sweeping technological change have led to restructuring, reorganization, and shifts in personnel structure. A telling example comes from a major insurance company with offices in New York City.[13] This firm once hired large numbers of clerks and messengers straight from high school. To maintain a pool of desirable entry-level candidates, and help in the selection process, the company took on as many as 2,000 high school students each summer; over the past dozen years, the number of summer jobs has been cut to 100. Rather than hiring high school graduates, the firm now seeks entry-level employees with at least an associate degree from a community college. As other studies demonstrate, this is hardly an isolated instance; some 20,000 unskilled entry-level jobs reportedly disappeared in New York City during the 1970s, as banks, insurance companies, and utilities replaced their clerks and runners with computers and information networks.[14] Currently, banks are hiring perhaps 20 percent of their new employees at the high-school level; 10 years ago, the proportions would have been reversed, with as many as 80 percent of newly hired workers having no more than a high school education.[15]

Given the explosion in higher education over the postwar period, it is hardly surprising that service companies in many industries now place a premium on hiring people with specialized expertise directly from colleges and universities. Why pay to train existing employees in the latest techniques of finance, marketing, or data processing when a generally slack labor market makes it is easy to hire someone new? Thus selection processes have shifted to emphasize credentials and schooling, to move the costs of training and skill development outside the firm, and to encourage lateral moves between companies rather than upward moves in an established internal labor market. As a result, many more people now split their time between work and school, studying part-time or at night to qualify for positions with prospects for advancement. Instead of on-the-job training and experience leading to a better position, Americans today are much more likely to hold one job while studying on their own for another, perhaps in a quite different field.

Stratification in the services, then, contrasts markedly with traditional patterns in manufacturing. There, labor unions sought to minimize differences in wages and working conditions among their members—differences that have become commonplace in the services. The comparisons across industries and occupations in tables 36 and 38 demonstrate the sharpness of

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[13] E. Ginzberg, T.J. Noyelle, and T.M. Stanback, Jr., "Technology and Employment: Concepts and Clarifications," Conservation of Human Resources, Columbia University, October 1985, p. 4-13.

[14] T. Bailey and R. Waldinger, "Employment Problems in the Shifting New York Labor Market," *New York Affairs*, summer 1984. Cited in T.J. Noyelle, *Beyond Industrial Dualism: Market and Job Segmentation in the New Economy* (Boulder, CO: Westview, 1987).

[15] Most of these new hires fill positions like tellers, where turnover has always been high. Even so, banks are now seeking out people with several years of college for such jobs. See O. Bertrand and T. Noyelle, "Changing Technology, Skills and Skill Formation in French, German, Japanese, Swedish and U.S. Financial Service Firms: Preliminary Findings," report to the Center for Educational Research and Innovation of the Organization for Economic Cooperation and Development, August 1986, table 1 (following p. 52).

Box X.—Restructuring in a Department Chain: The Macy's Case[1]

Career paths in retailing have changed radically in the United States, a process still underway. Rising consumer spending after World War II, and the growth of the suburban middle class, led to intense competition. Established downtown department stores like Macy's began moving to the suburbs and to shopping centers in order to meet competition from newer discount retailers (e.g., K-Mart) as well as mass merchandisers (Sears, J.C. Penney). Most of the expansion took place outside the major urban centers that had been strongholds for chains like Macy's. Many small independent stores in the cities vanished; survival for both large and small meant restructuring to serve the growing suburban market.

In 1948, R.H. Macy & Co., established 90 years earlier, operated six large stores and a few smaller branches. Over the next 30 years, the company opened more than 80 new outlets. In battling the discounters, Macy's first tried to imitate them, but with little success. Seeking a new strategy that would prove more effective, the company went through a series of rapid changes as it opened new stores, revised its managerial and administrative procedures, and installed computer systems for accounting, billing, and inventory control. Major shifts in the structure of employment followed.

The most fundamental change entailed separating store management from merchandising. Originally, each department in a store was the responsibility of a "buyer," who personally selected the merchandise to be stocked in his or her department. Buyers not only handled marketing, but they hired the sales staffs for their departments. Management and merchandising were integrated in the person of the buyer. Rapid expansion doomed this system, in which each buyer operated as a nearly independent agent. There were far too many stores, too many departments; coordination was impossible, costs could not be controlled. In Macy's new structure, divisional administrators supervised purchasing and merchandising for an entire (geographic) division. Store management had its own hierarchy; managers ran their stores, but no longer supervised the selection of merchandise.

With two parallel chains of responsibility—one for merchandising, one for store management—good communications between the two sets of line administrators and managers were vital. To aid in this, and to help develop the large numbers of new managers needed to staff their growing company, Macy's executives required line managers to move back and forth between store operations and merchandising as they advanced. (The restructuring also involved extensive changes in other parts of the organization—e.g., financial management.)

Below these managerial and administrative levels, the break with the past has been just as sharp, although for different reasons. With stores remaining open in the evenings and on weekends, a work force that had been two-thirds full-time in the mid-1960s became two-thirds part-time by end of the 1970s. Macy's turned to part-time employees not only to cover longer store hours, but also to reduce labor costs. Fringe benefits as well as pay scales could be trimmed for part-time employees, few of whom advance much beyond the minimum wage. In recent years, three out of four of those on the sales floor (who comprise four-fifths of the nonmanagerial staff) have been part-time workers. In the back-store jobs (shipping and receiving, stockrooms and distribution centers) that comprise the remaining fifth of the company's nonmanagerial labor force, only one in four employees works part time.

The demographics of the sales staff have changed as well. Once mostly white females over age 30, today the typical sales clerk is younger and more likely to be a minority (although women have actually risen from about 70 percent of the company's total work force in 1966 to 74 percent in 1982—largely because computers have taken over much of the back-store work once performed by a largely male clerical staff). While Macy's has placed more women in managerial positions in recent years, most of the firm's female employees still work in low-level sales jobs; the company has made less progress in placing minorities than women in managerial and professional positions.

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[1] Based on T.J. Noyelle, *Beyond Industrial Dualism: Market and Job Segmentation in the New Economy* (Boulder, CO: Westview, 1987), Chapter III (Retailing: The Case of R.H. Macy & Co.).

When buyers ran their own departments, Macy's employees could move into junior management positions from the sales floor. Starting in an entry-level job such as greeting card sales or as a stock clerk, they might work their way into a lead or commissioned sales job (handling, say, furniture or major appliances), eventually into supervision (e.g., as an assistant buyer). People could and did enter at the bottom, become buyers, and rise to be store managers. The new managerial structure has effectively blocked these channels, with the shift toward a part-time sales force also contributing. Today, sales-floor employees, for practical purposes, are stuck where they are. Management trainees are hired in from college (or sometimes from other firms), normally beginning in supervisory positions on the floor. The next step—over to the merchandising side—is an assistant buyer's job. Steady advance through the management hierarchy is the reward for those who perform best—although turnover is high, with many people leaving, voluntarily or involuntarily, to be replaced by a new crop. (Turnover is also high among the sales staff.)

In the back of the store, computer-based systems have taken over account processing and billing, financial and inventory control. Most of the routine jobs have disappeared; in some stores, two or three people do work once handled by 25 or more stock clerks. As a consequence, the back-office staff has shifted toward skilled and professional employees who can maintain and use the new equipment. Macy's hires in many of these people because of their skills; opportunities for low-skilled employees to learn on the job are limited.

Macy's has achieved its objectives. During the 1970s, costs were cut and productivity grew rapidly. The proportion of sales people in the labor force has not changed much, but employment has otherwise shifted away from clerks and laborers toward managers and professionals.

With a college education the prerequisite for entering on the managerial track, and the back-store shift toward higher skill levels, earnings patterns for Macy's employees have become bimodal. At the upper end are the executives, managers, and professionals—at the lower end, the sales staff, largely part-time, together with the smaller number of clerks and laborers still needed in the back of the store, on the loading docks, for mopping the floors.

Macy's restructured under intense pressures from discount retailers. Forced to cut costs while expanding rapidly, senior managers felt the company could no longer rely on an internal labor market; they brought in trainees directly from college, invested heavily in data processing equipment, and sought to impose discipline on their buyers' fiefdoms. The new requirement of a 4-year college degree for entry on a management track, plus computer automation, effectively closed off career ladders that earlier gave employees with high-school backgrounds the opportunity to advance.

the distinctions in pay, frequency of part-time work, age, and educational background among workers in differing sectors. With stratification on the rise in the U.S. labor market, severe strains could develop if younger entrants, perhaps including those with college degrees, face career prospects and living standards inferior to those of their parents.

TEMPORARY AND PART-TIME WORKERS[16]

With domestic and international competition forcing American firms to cut costs, many have turned to contingent workers—e.g., people with temporary or, more commonly, part-time jobs—in search of flexibility. Using short-term, project-related, or part-time employees rather than

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[16] Much of this section is based on "International Competition in the Service Industries: Impacts of Technological Change and International Trade on U.S. Employment," op. cit., ch. 4, including specifics not otherwise cited. The data on part-time employment in figure 46 and elsewhere below cannot be directly compared with that in tables 36 and 38. The two earlier tables use the Census definition for full-time employment—35 hours or more per week *plus* at least 50 employed weeks per year—rather than the Bureau of Labor Statistics definition of 35 hours or more per week *at the time of the survey.*

Box Y.—Deregulation, Expansion, and New Technology at New York Telephone[1]

During the 1970s, new competition stemming from deregulation, along with exploding residential and commercial demand in the New York metropolitan area, led to massive organizational change at New York Telephone (NYT)—organizational change that was possible only because of the replacement of electromechanical switchgear by computerized systems. Reorganization stemming from deregulation culminated, at least for the time, in the AT&T breakup—which left NYT a division of NYNEX, one of the Bell operating companies. Other forces for change—notably, the ever-expanding telecommunications needs of businesses in the New York area—will continue and perhaps grow stronger.

Also contributing were circumstances in earlier years that had left NYT's equipment in a state of disrepair; because so much of its switchgear was obsolete, and because demand was growing so fast, when NYT began installing computerized switching equipment, it did so at higher rates than many other telephone companies. An entirely independent set of forces were also at work. Shifts in NYT's personnel structure came faster and cut more deeply because of a lengthy strike during the early 1970s. In addition, a poor affirmative action record led NYT to accept a new set of personnel practices as part of a consent decree negotiated with the Federal Government. As a result of this consent decree, the company nearly stopped its hiring on the outside, moving women and minorities into more desirable jobs at a time of shrinking overall employment. When NYT resumed hiring in substantial numbers, it sought college-trained engineers, professionals, and management trainees to help it deal with new technical and marketing needs.

As the end of the 1960s approached, NYT had been deferring investment and postponing maintenance because of low profits. Meanwhile, demand skyrocketed. The company was ill-prepared to meet a market growing by hundreds of thousands of new lines per year. Service was poor, equipment broke down, customers complained.

Infusions of capital from AT&T—more than $10 billion during the 1970s—rescued NYT from crisis. Meanwhile, a largely fortuitous series of events contributed to major changes in work rules and job descriptions, and thus to the structure of employment. In 1971, NYT's union called a strike—one that was not to be settled for 8 months. To maintain service, engineers, managers, and supervisors took over many of the tasks of the striking union members. Other AT&T divisions flew in planeloads of professional and managerial personnel on weekends. As the strike lingered, these non-union personnel installed some 700,000 new telephones, carried out the necessary maintenance on central switching systems, learned to climb telephone poles. This unplanned training convinced NYT's management of the need for sharp cuts in some parts of the company's labor force, and of a parallel need for changes in the content of many jobs.

Three primary forces shaped the restructuring that followed the strike: 1) new technology, primarily in the form of electronic central office (CO) switching equipment; 2) affirmative action requirements; and 3) the changing market for telecommunications services. Much of NYT's new investment went toward electronic CO switches. In essence large computers (ch. 5), they needed little routine maintenance compared to the older electromechanical switchgear. What maintenance they did require called for new skills—e.g., editing computer programs. Engineers and computer specialists took over most of this, including trouble-shooting. Switchmen—the craft workers who had maintained the old electromechanical equipment—were relegated to the simpler and more mundane tasks that still needed to be performed; in effect, their jobs, when not eliminated, were deskilled. A CO switching system once manned by a crew of 30 to 40 switchmen could now get by with 2 or 3.

Furthermore, with the new electronic exchanges, a much smaller complement of operators could handle a given volume of traffic. Computers took care of the bulk of the routine calls. NYT's operators were needed mostly for directory assistance and international dialing.

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[1] Based on T.J. Noyelle, *Beyond Industrial Dualism: Market and Job Segmentation in the New Economy* (Boulder, CO: Westview, 1987), Chapter IV (Utilities: The Case of New York Telephone).

Change was just as rapid in the field. Computer-based customer equipment—e.g., PBX's (private branch exchanges)—was easier to install, easier to maintain. Cuts in jobs for equipment installers followed, especially after new regulatory decisions permitting customers to hook up their own telephones. At the same time, deregulation and new competition led the company to beef up its marketing staff.

Between 1972 and 1977, NYT's work force dropped from 106,000 people to 75,000. At the end of this period, the company employed about the same number of skilled and craft workers (for a much larger equipment base), but a smaller number of operators. The percentages of sales representatives, managers, and professionals in NYT's work force were up substantially. (Like other large businesses, NYT moved rapidly to computerize its billings and accounts over these years, which also had major impacts on staffing patterns.)

Federal legislation in the form of affirmative action standards came into play during the middle 1970s. In earlier years, as the company had grown, most of the craft jobs (e.g., switchmen and linemen) went to white males. Women filled almost all the openings for operators and in customer service departments. Blacks were found mainly in janitorial and other support roles. Operating under guidelines for hiring minorities and women set out in a 1973 consent decree negotiated with the Justice Department, NYT began moving women, blacks, and other minorities into more desirable jobs. Simultaneously, the company's overall employment was shrinking; for a time, NYT all but stopped hiring on the outside, filling openings by offering them to existing employees. (In 1970, the company had hired some 35,000 people, while 30,000 others left.)

Affirmative action—combined with new technology that cut back on the need for craft workers, plus competition that forced NYT to begin actively marketing its services—meant very high rates of lateral job transfers. Operators could become sales representatives; switchmen became equipment installers. Mobility increased within the firm; new internal job ladders appeared; formerly closed opportunities opened. But this period proved short-lived.

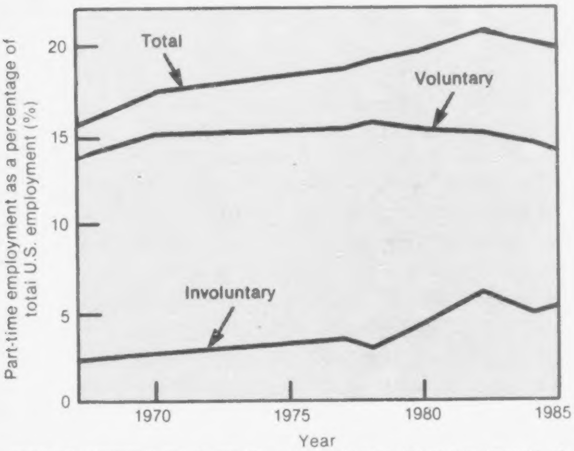
As it responded to growth in the New York market for telecommunication services, and particularly to increasing competition, NYT began searching out managers and other employees with specialized expertise in fields ranging from engineering and marketing to finance and law. Trying to stay ahead of rivals who seemingly offered new rate structures and new services almost daily, NYT was becoming professionalized. With the shift from line to staff personnel, typified by the new emphasis on marketing, the frequency of internal promotions dropped during the 1970s (except for shifts mandated by affirmative action, many of which were lateral as much as vertical). Cost pressures, together with the pace of change, discouraged internal training; it was quicker and cheaper to hire people with needed skills, rather than retrain existing employees as computer programmers or marketing specialists. In many cases, new entrants took positions that in earlier years would have been filled through promotions from within.

Today, NYT hires almost exclusively on the outside to fill professional and managerial openings, with a college or vocational-technical degree the minimum job qualification. No longer is NYT a craft-oriented company, in which employees could progress via seniority and on-the-job training up a skill ladder and perhaps into a supervisory position. While many older men without college degrees can still be found in NYT's middle management ranks, they are the last of their kind.

full-time staff is a simple way to adjust for variations in demand. Work that once took place within a large firm (or public organization) may be subcontracted to small companies, or to individuals. Subcontractors, in turn, may have people on-call so that they can respond quickly. A recent survey of some 5,000 American firms found many more in the services than in manufacturing relying on part-time and temporary employees; fewer than 6 percent of the companies questioned reported that they planned to replace any of their part-time or temporary workers with full-time staff during 1987.[17] In a typical case, a U.S. bank that had formerly staffed its branches exclusively with full-time employees began, in 1984, to fill all new vacancies with part-time workers. The bank's managers sought to restructure their work force so that they could cover peak hours without having extra people on hand at other times.

On the supply side of the labor market, self-employment has been growing—to some extent in response to new opportunities. For instance, skilled workers and professionals, whether engineers or truck drivers, may choose to work as independent contractors. But some self-employment, like much other contingent work, is involuntary—as when an accountant who has been laid off or pushed into early retirement starts an income tax service. As figure 46 shows, involuntary part-time work now accounts for 5 to 6 percent of total U.S. employment—small as a percentage but large in absolute terms (5.5 million at the beginning of 1987); growing numbers of Americans take part-time jobs, not because they want to, but because they cannot find desirable full-time positions.

Figure 46.—Part-Time Employment in the United States



SOURCE: "International Competition in the Service Industries: Impacts of Technological Change and International Trade on U.S. Employment," prepared for OTA by E. Appelbaum, P.S. Albin, R. Koppel, and F. Hormozi under contract No. 533-5560, table 4-5.

When all contingent workers are added together—the self-employed, together with part-time, temporary (voluntary and involuntary), and contract workers, plus illegal immigrants and people who work at home or in the underground economy—the total reaches 25 to 30 percent of U.S. employment.[18] Some of these people become eligible for fringe benefits such as retirement plans, health insurance, and paid vacations. Most do not. For only a few does a contingent job represent one step on a career ladder; indeed, almost by definition, contingent workers—those without a lasting association with some company—have no access to internal labor markets. *This ongoing change in the U.S. labor market transfers much of the risk associated with business downturns, illness, and other interruptions in people's ability to work from companies to individuals.* American corporations have begun looking to temporary employees, in particular, as buffers—much as in more primitive economies, where casual work is common.

Because typical service products cannot be held in inventory, but must be supplied on demand, it is no surprise that service companies employ many more people on a temporary or part-time basis than goods-producing firms. Table 36 showed that half or more of the labor force in some service sectors works part time.

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[17] J.W. Duncan, "Survey Shows Continued Use of Temporary and Part-Time Workers," *Dun & Bradstreet Looks at Business*, November/December 1986, p. 1.

On the bank example, below, see "Changing Technology, Skills and Skill Formation in French, German, Japanese, Swedish and U.S. Financial Service Firms: Preliminary Findings," op. cit., pp. 40-41. At the same time, this bank raised the minimum requirements for entry-level employees. Formerly, it had hired mostly high-school graduates; now the bank sought women with at least some college.

[18] "Trends Toward Labor Flexibility in the Reported and Unreported Economy," prepared for OTA by S. Christopherson under contract No. 533-5745.

A number of large American corporations—including New York Telephone and Blue Cross/Blue Shield—have begun homework programs, through which "independent clerical contractors" can do jobs such as data entry from their homes (p. 14). While it seems likely that no more than 10,000 Americans now do this kind of work, about 90 percent on a part-time basis, some 250 firms now have homework programs. The companies tend to view them as experiments; homework could expand substantially in the future.

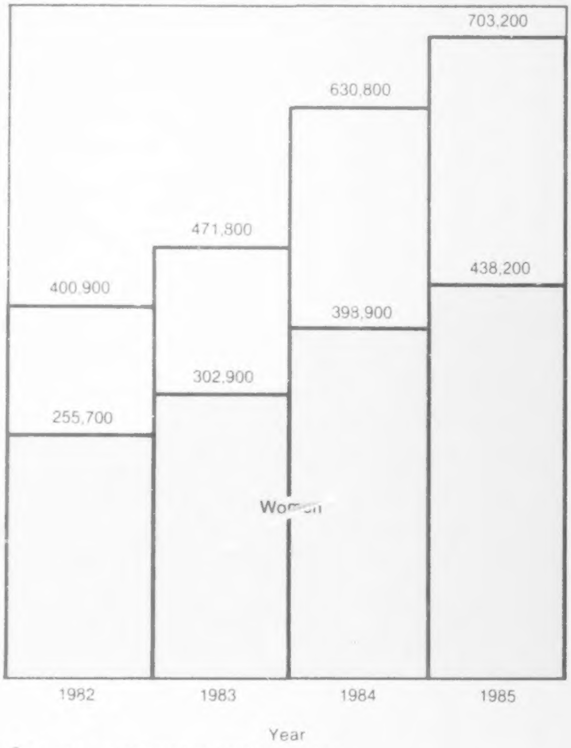
Many service firms employ large numbers of people on a part-time basis simply because they need staff to cover long and odd hours, as the Macy's case or the bank example above illustrate. Nursing homes, day care centers, and restaurants provide other illustrations, along with retailers who hire extra workers in peak business periods before Christmas.

In manufacturing, a far greater percentage of employees work a regular full-time week, although some manufacturing firms do bring in temporary workers to cover periods of high demand. Many have also begun hiring temporary employees with specialized skills for short periods, and contracting for services including factory maintenance, drafting, technical writing, and plant renovations—in many respects a widening of business services categories beyond such traditional functions as auditing and accounting, advertising and market research, and legal services. Contract engineering by job shops, for example —prominent in defense and aerospace since the 1960s—has begun to penetrate other manufacturing sectors much more deeply.

Temporary Employment

Traditional routes to staffing flexibility include seasonal hiring, periodic layoffs, and keeping a tight labor force while paying for overtime when necessary; companies in seasonal businesses like toys may double their employment while producing for the Christmas rush. For decades, also, temporary help agencies have been supplying office workers. More recently, temporary help has become one of the faster growing service industries and service occupations in the U.S. economy, expanding at more than 10 percent per year.[19] As figure 47 indicates, in 1985 the industry placed an average of over 700,000 workers each day, more than 60 percent women. In 1982, 0.65 percent of women holding nonagricultural jobs worked for a temporary help services agency, a figure that reached 1 percent in 1985. Note that figure 47 does not include the growing number of temporary workers hired directly by companies, rather than through an agency.

Figure 47.—Employment in the Temporary Help Services Industry[a]



[a]Annual averages based on monthly reporting.

SOURCES: *Employment and Earnings*, Supplement, Revised Establishment Data, 1984, p. 309; 1985, p. 156; 1986, p. 178. *Employment and Earnings*, 1984, 1985, and 1986, various issues, tables B-2 and B-3.

With clients demanding a broader range of skills, the temporary help services industry has diversified well beyond the typists and clerical workers who were its mainstay 15 years ago.

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[19] Employment growth in the temporary help services industry has averaged 11 percent a year over the last 13 years, compared with a 2.1 percent growth rate for nonagricultural jobs in general—H. Collins, "Unions Decry Trend to Short-Term Federal Jobs," *Philadelphia Inquirer*, Feb. 5, 1986, p. B1.

The Federal Government itself filled nearly 250,000 jobs with temporary employees during 1984 (as reported by the Office of Personnel Management), a number expected to continue increasing as a result of new regulations governing the employment of temporary workers that took effect at the beginning of 1985. Federal officials publicly welcomed the new rules. Hiring temporaries, who have no civil service protection, makes it easier for Federal agencies to adjust the size of their work forces while cushioning permanent employees against lay offs. Moreover, the temporary jobs carry no medical or retirement benefits other than social security.

Silicon Valley electronics firms, for example, can now call a temporary agency for extra assembly workers. Half the temporaries placed by agencies currently fall outside the category of office workers. For 1984, estimates of the industry's placements in terms of revenues break down as follows: office workers, 49.4 percent; professional and technical, 34.4 percent; health service workers, 8.8 percent; and, industrial workers, 7.4 percent.[20] Although still relatively small in absolute terms, health service temporaries—most of them supplied to hospitals and nursing homes—comprise the fastest growing category. Hospitals rely on temporary help agencies for growing numbers of nurses, laboratory and other technicians, therapists, and housekeepers. Many also use nurse's registries and call-ins.

The temporaries in greatest demand by manufacturing companies tend to be people in service occupations, not production, with generic rather than industry-specific skills. One survey of chemical and electronic components manufacturers found that most of the electronics firms used temporaries to fill technical jobs (drafting, computer programming, technical writing and illustrating, electrical engineering), while chemical firms continued to call mostly for office workers (secretaries, receptionists, word processing operators, file clerks, messengers). Chemical firms did use technicians and engineers on a temporary basis, but less heavily than in electronics.

Banks also use temporaries in positions calling for relatively standardized skills—file clerks, bookkeepers, data-entry technicians, messengers, security guards—the sorts of occupations in which temporary help agencies specialize. But banks have also begun filling transient needs with people who have more specialized skills—e.g., experience in banking practices and procedures, even firm-specific knowledge of financial products. How do they accomplish this? Primarily by creating internal labor pools of full-time employees who move as required from one branch or office to another. From the employee's perspective, of course, though specific assignments are temporary, employment with the bank (or other service firm) need not be. Some banks now maintain floating pools of branch managers and operations managers, as well as tellers and new account clerks.

Self-employment and independent contracting, two other forms of contingent employment, have also been expanding in the United States. Men who are self-employed tend to work in construction and in transportation, communications, and utilities. The available data suggest that most self-employed women and minorities work in retail trade and other tertiary services; in 1980, for example, approximately 800,000 self-employed women worked in trade, while another 1.2 million found employment in "other services." These sectors, particularly trade, also attract many self-employed white males. Independent contractors have, in addition, become a major source of skilled and professional workers for industries needing short-term specialized services ranging from graphic design to systems analysis.

Part-Time Work, Voluntary and Involuntary

As figure 46 indicated, the fraction of part-time employees in the U.S. labor force has been in the vicinity of 20 percent since the latter part of the 1970s—compared with about 15 percent during the 1950s. Involuntary part-time work has been expanding slowly but steadily—from 2 percent of the total labor force in 1967 to more than 5 percent during the slack employment periods of the 1980s. Part-time employees who would prefer full-time jobs have recently made up 25 to 30 percent of the 20 million Americans working less than 35 hours per week. Figure 46 also shows that, since the latter part of the 1970s, the entire increase in part-time employment in the United States can be accounted for by growth in involuntary part-time work.

Historically, women have been far more likely than men to take part-time positions (table 39); a third of all women work part-time, compared with 15 or 16 percent of men. Furthermore, the proportion of women taking part-time jobs in-

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[20] "International Competition in the Service Industries: Impacts of Technological Change and International Trade on U.S. Employment," op. cit., ch. 4, pp. 9-10.

Table 39.—Industry Profile for Men and Women Employed Part-Time, 1984

	Percentage of those employed working less than 35 hours per week[a]	
	Men	Women
Total	15.9%	32.6%
Manufacturing	9.2	17.3
Trade	23.5	47.7
Retail	28.8	50.9
Finance, insurance, and real estate (FIRE)	12.4	20.1
Service	19.9	35.7
Business and repair	17.9	35.2
Personal	20.9	41.8
Other professional	12.4	27.0

[a] Annual averages, excluding agriculture.

SOURCE: "International Competition in the Service Industries: Impacts of Technological Change and International Trade on U.S. Employment," prepared for OTA by E. Appelbaum, P.S. Albin, R. Koppel, and F. Hormozi under contract No. 533-5560, from unpublished Bureau of Labor Statistics data.

voluntarily has nearly doubled, from 12.1 percent of those employed part-time in 1970, to 22 percent in 1985. Note that table 39, based on monthly averages, tells only part of the story. The number of Americans who experience involuntary part-time employment *at some point during the year*—because their employer puts them on short hours, or because a part-time job is all they can find—is much higher than the monthly figures suggest. During 1983, 14.9 million Americans experienced some period of involuntary part-time employment.

Part-time jobs cluster by industry more than temporary employment, with over 70 percent of all part-time workers found in trade and "other services." While companies often use temporaries—many of whom work variable hours—as buffers, part-time workers tend to fill more predictable needs. For instance, restaurants and other retail establishments typically prefer to have their own people available, with firm-specific training and experience, rather than call on temporaries. Not only is customer service an important part of such jobs, but supervision is more difficult than in an office environment. As noted earlier, part-time work in many service industries—not only wholesale and retail trade, but entertainment, recreation, and "other services"—is in a part a function of lengthening business hours. More women than men work part-time in such industries because they are more likely to have sales jobs. (In Macy's stores—box X—women work on the floor, men on the loading docks.)

Perhaps 20 to 25 percent of those who work part-time hold two or more jobs—by choice or by necessity. Roughly 5 million Americans report that they hold multiple jobs; the number has been growing at about the same rate as the overall size of the labor force. Larger than average numbers of moonlighters work one of their jobs in public administration (7.6 percent, clustered particularly in teaching and in State and local government), agriculture (6.1 percent), and "other services" (also 6.1 percent).

Multiple job-holding by women rose steeply during the 1970s. Men tend to hold one job on a full-time basis, working part time elsewhere; 40 percent of male moonlighters are self-employed in their second job. In contrast, nearly half of all women working two jobs hold both on a part-time basis. Much part-time self-employment takes the form of unreported work in the underground economy (discussed below); men are much more likely to freelance on a cash or barter basis, while women tend to hold second jobs in the above-ground economy. Multiple job-holding by men also appears to be more cyclical, increasing when opportunities rise during periods of economic expansion, dropping back during recessions. Multiple job-holding by women, in contrast, has shown steady growth since the 1960s. More men than women claim they hold a second job because they enjoy it, or because they are saving for the future; women, especially minority women, work multiple jobs to meet their day-to-day expenses.

IMMIGRANTS IN THE U.S. LABOR FORCE[21]

In 1965, Congress amended the Immigration and Nationality Act, increasing the number of immigrants who could be admitted each year as workers with needed skills (to 290,000), while tightening the certification requirements. In addition, the 1965 amendments eliminated quotas based on national origin, and made it easier for family members of U.S. citizens to enter. Immigrants can also be admitted as political refugees; in some years, nearly as many people have entered outside the occupational preference system—i.e., as refugees or under the family reunification provisions—as through it. The Immigration Reform and Control Act of 1986 left the system for legal entry largely unchanged.

The amendments have changed the mix of skills, educational backgrounds, and occupations that immigrants bring to the U.S. economy. Under the earlier national origin quotas, more than half of all immigrants came from Europe. Since 1965, the immigrant stream has become much more diverse, and shifted toward entrants from Asia and Latin America, with Europeans dropping below 20 percent of the total. Relatively large fractions of professionals (e.g., nurses, physicians, engineers) have entered under the occupational preference system. At the same time, many women with low skills have been admitted under the family reunification provisions; they have increased the supply of workers in tertiary service industries. (Women constitute slightly more than half of all immigrants.)

During the first half of the 1980s, 2.8 million immigrants entered legally. Illegal aliens—of whom there may be 2 million to 5 million—differ from legal entrants in demographics, skills, and countries of origin (many more come from Mexico). As a whole, immigrants cluster into two groups at the high and low ends of the skill/pay spectrum: in this sense, U.S. immigration policy reinforces the two-tiered pattern that characterizes employment in the Nation's service industries.

Immigration adds to the size of the U.S. labor force, and immigrants compete for jobs with native-born Americans. Given the unemployment and underemployment that have typified U.S. economic performance in recent years, it is probably fair to say they have taken some jobs from native-born workers. At the same time, as pointed out in chapter 6, American industry has come to depend quite heavily on foreign-born engineers and scientists, many of whom first come to this country to further their education. A balanced view of the impacts of immigration must take account of such factors, as well as the overall thrust of immigration policy in a country that historically has welcomed people from abroad.

Distribution by Occupation and Industry

More than half of all immigrants, legal and illegal, live in California, New York, Florida, and Texas—mostly in large metropolitan areas. New entrants with professional and technical skills tend to settle in the same areas as the rest of the immigrant population, with some exceptions such as physicians. Many of the latter start practices in small towns and rural areas that offer them better opportunities.

Women and children who report no occupation make up 60 percent of legal immigrants, generally entering under the family reunification provisions. With the advent of more stringent labor certification requirements in 1965, the number of entrants listing professional/technical occupations more than doubled; about one in four of the current immigrant labor pool claims such an occupation, compared with 17 percent for the U.S. labor force as a whole. Of 209,000 immigrants in 1983 who designated an occupation on admission, 39,000 fell into professional or technical categories—19 percent of those listing occupations, and 7 percent of all immigrants. Nearly half of those declaring a professional/technical occupation fall into one of four categories—engineers, nurses, physicians (and dentists), and teachers. Engineers comprise the largest group, accounting for about 17 percent of professional/technical entrants in 1983, with the other three occupations each representing about 10 percent.

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[21] This section is based on "Immigrants in the Service Sector," prepared for OTA by S. Christopherson under contract No. 533-5745.

In general, immigrants from Latin America are less likely to report a white-collar background than those from Europe or Asia, more likely to be unskilled and female. By the late 1960s, Asian countries—India, the Philippines, Taiwan—had replaced Europe as the source of most professional and technical immigrants; less than 2 percent of entrants from Mexico claim a professional or technical occupation, compared with 14 for the Philippines and 19 percent for India. However, occupations reported at entry do not necessarily correlate with the jobs that immigrants find in the United States. Many are downwardly mobile, at least at first.

Most immigrant professional and technical workers take routine jobs in their fields, or move laterally and downward. Physicians may have trouble gaining a medical license; accountants may have to accept jobs as bookkeepers or clerical workers. Not only may immigrants have inferior skills, but some employers no doubt discriminate against them. The effects of immigration on U.S. labor market conditions, therefore, cannot be directly inferred from occupations listed on entry. The "fourth wave" of immigrants—those entering since 1965—will probably have trouble catching up in terms of skills and income with native-born Americans. This conclusion holds at both the high and low ends of the skill/pay spectrum, although low-skilled immigrants can expect to be upwardly mobile in the United States, as compared to their countries of origin.

If immigrants are more likely than the average U.S. worker to claim professional/technical skills, they are also twice as likely to be unskilled laborers and four times as likely to be domestic workers. The split between high and low skills is sharper for women than for men. While many immigrant women do fall at the professional end (the largest single group consists of nurses), much larger numbers cluster at the bottom. Almost all the women admitted under the occupational preference system in recent years have been either professionals or low-skilled service workers (including housekeepers, dressmakers, and household servants); the proportion of immigrant women with clerical occupations is only half that for women in the U.S. labor force as a whole. Occupational profiles for male immigrants resemble those for the rest of the male labor force more closely.

Illegal Immigration

Largely because the vast majority of illegal aliens come from Mexico, this group differs greatly in terms of skills and occupations from those who enter legally. Many more illegal immigrants cluster at the low-skill end of the spectrum. Although skilled workers and white-collar professionals have entered illegally in some numbers—e.g., from the Philippines—little is known about these people; almost certainly, however, the professional/technical group is relatively much smaller than for legal immigrants.

Taken together, the many studies on illegal aliens suggest numbers in the range of 2 million to 5 million, with estimates for the Select Commission on Immigration and Refugee Policy indicating 3½ million to 5 million (something under 3 million from Mexico). Many undocumented workers, especially those from Mexico, stay in the United States for only a few months, making estimates more difficult. Most illegal aliens live in major U.S. cities, with a distribution by State similar to that for legal entrants.

Although many undocumented workers take jobs in agriculture, they have also moved in relatively large numbers into blue-collar manufacturing. Surveys show that more than half the Hispanic women entering illegally find work in manufacturing (versus about 10 percent for women in the U.S. labor force as a whole)—e.g., in the southern California garment industry. Large and increasing numbers of illegal entrants from Mexico and the rest of Latin America do construction work, or take jobs in restaurants and other service firms.

Like legal entrants, illegal aliens—except for those from Mexico—tend to be downwardly mobile in the United States. Many who enter from Mexico move from agriculture into construction and manufacturing, or upward in terms of service occupation. In some contrast, people with white-collar backgrounds entering illegally from countries like El Salvador or the Philippines often find themselves in lower status white-collar jobs than they formerly held.

Immigrants and Jobs

Do immigrants take jobs and job opportunities from native-born citizens? Assuming that immigrants gradually become assimilated into the U.S. economy, seeking to move up job ladders and otherwise compete with native-born workers having similar educational backgrounds and skills, the answer must be yes. On the other hand, to the extent that immigrants find work in labor market segments where few native-born Americans seek jobs—because, for example, of the nature of the work (domestics and custodians)—then it is equally fair to say that immigrants contribute their labor to the economy without taking jobs from those born here.

Legal immigrants with professional and technical backgrounds compete with native-born workers in nursing, medicine, engineering, and other white-collar occupations. These professions have traditionally provided relatively open channels of advancement for anyone who enters—including native-born women and minorities—because skills can be obtained through schooling rather than apprenticeship or on-the-job training. While there has sometimes been evidence of oversupply in such fields, serious unemployment seems unlikely; health care, for example, is still growing rapidly. Frequently, as with the small-town physician, immigrants fill slots at the bottom of the pay and status ladders for their occupational group. In the professions, crowding out by immigrants would seem unlikely. The most severe impacts of immigration have been felt, not in the United States, but in the countries these people have left, some of which have suffered severe drains of talent. At the same time, with unemployment remaining high, and underemployment on the rise, immigration can only make things more difficult for native-born Americans with poor education and low skills.

THE UNDERGROUND ECONOMY[22]

The major categories of underground economic activity—those that escape the national accounts—have little in common except their unreported nature. Underground economic activities include: 1) explicitly illegal activities such as prostitution and drug dealing; 2) unreported wages and salaries, along with other legal transactions that shield earnings (including capital gains and dividends) from taxation; and 3) goods or services obtained through barter. By all estimates, unreported earnings from otherwise legal activities makes up the largest of these categories.

The limited information available on the composition and growth of work in the underground economy points to close relationships with broad changes visible elsewhere in the labor market. For example, unreported wages and salaries appear to correlate with the increase in part-time and temporary work in the United States, particularly among those who hold multiple jobs; in general, underground employment appears to have grown at about the same pace as overall U.S. employment, with more people working off-the-books when the economy picks up, presumably because they have more opportunities.

Attempts to estimate the size of the underground economy depend on relatively arbitrary assumptions. As for illegal immigrants, the estimates cover a considerable range. Moreover, most of the surveys and other estimating procedures have focused on individuals and households, rather than businesses, although unreported transactions between companies more than likely exceed those involving individuals and households (perhaps by a large margin). Thus more data have been collected on, say, unreported cash income for people working as cab drivers, house painters, and waitresses than for transfers of funds overseas by businesses seeking to avoid taxation.

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[22] This section is based on "Trends Toward Labor Flexibility in the Reported and Unreported Economy," prepared for OTA by S. Christopherson under contract No. 533-5745.

Because most people who work off-the-books also hold above-ground jobs, estimates of unreported wages or revenues, such as those made by the Internal Revenue Service, cannot be directly related to employment levels. Estimates based on conservative assumptions have placed *full-time* underground employment at about 4 percent over and above reported U.S. employment levels—perhaps 5 million people currently.[23] The number of people working on a part-time basis in the underground economy is no doubt several times greater.

Most of the studies of the underground economy suggest that the trends explored earlier in the chapter—particularly the use of contingent workers by businesses seeking greater flexibility—have contributed to its growth. Companies that hire people off-the-books (which may include illegal aliens) not only avoid paying fringe benefits, but also payroll taxes. If they can hide some of their revenues, they may also be able to escape income taxes. These processes feed on one another. Contingent employment increases risks for the worker; with less assurance of future wages, more people will supplement their income as opportunities come along. Some of these opportunities may go unreported —working extra hours in a regular job for cash, doing auto or home repairs for a neighbor. Deregulation and a free-market approach to economic activity mean increased uncertainties. Work in the underground economy becomes more tempting for Americans seeking a hedge against an unknown future.

CONCLUDING REMARKS

From 1972 to 1984, American companies created nearly 21 million new jobs. Given the size of the Nation's economy, the patterns revealed by the 1980 census have been changing relatively slowly; nonetheless, the trends are unmistakable. Manufacturing jobs will continue to decline relative to the services, and almost certainly in absolute terms as well. The trade, FIRE and "other service" industries will expand, creating jobs that, on many dimensions, make poor substitutes for the manufacturing positions that the U.S. economy created in large numbers during the earlier postwar period:

- Everything else the same, jobs in the services pay less than jobs in manufacturing. This is true for both skilled and unskilled work, and for most managerial positions.
- Prospects for upward mobility in the services tend to be limited. Entry into jobs with such prospects commonly requires specialized educational credentials (or other evidence of retrainability).
- While women fill a higher fraction of managerial jobs in the services than in manufacturing, many of the women who have entered the service industries earn relatively little and face very restricted career opportunities. As women moved into the labor force in greater numbers, companies restructured work to employ them on a part-time basis. Many well-educated women in industries like banking and insurance fill dead-end jobs that consist basically of skilled clerical work.

Formal education and training as a route to upward mobility has become more important as workplace technology has grown more complex. While new technology deskills some jobs, it upskills others—processes explored in the next chapter. With companies, in effect, seeking people with education/training credentials that indicate an aptitude for ongoing retraining, only those who are prepared can take advantage of the opportunities opened by upskilling. One of the functions of higher education, at least in theory, has been to equip people for continuing learning. Both colleges and vocational/technical schools will have to do this in fact as well as in theory if the U.S. economy is to prosper in the years ahead.

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[23] D. O'Neill, *Growth of the Underground Economy 1950-81: Some Evidence From the Current Population Survey*, report to the Joint Economic Committee (Washington, DC: U.S. Government Printing Office, Dec. 9, 1983). An estimated 800,000 of these people are self-employed.

New entrants and displaced manufacturing workers whose backgrounds make them ill-suited for retraining will have a difficult time—in contrast to many of those who entered the manufacturing sector in earlier years with little education, but went on to achieve relatively high career earnings. Many such people will find themselves confined to occupations like sales or clerical work. Their earnings potentials will suffer, particularly in comparison with unionized manufacturing workers; for many years, wage levels in manufacturing have remained above those for most non-manufacturing workers by a relatively constant margin. Moreover, differences between the social environments of work in manufacturing and in the services will continue to limit opportunities for displaced manufacturing workers.

The knowledge-based service industries show sharp divisions between people with jobs high in pay and in skill requirements (loan officers, stockbrokers) and occupations low in pay and skills (bank tellers, data-entry clerks). As employment in the services has increased, a two-tiered wage pattern has emerged. At the high end of the scale, a minority of technical and professional workers, many of them in computer-related occupations, can expect high earnings and ample opportunity to move upward. A much larger group appears stuck at the bottom. A slack labor market, the largely non-union environment of the services, and competitive pressures in industries like retailing—populated by very large numbers of firms—mean constant downward pressure on wages. Crumbling internal job ladders in many service firms reinforce the tendencies toward stratification, making it more difficult to move upward via seniority and on-the-job experience. Broader access to schooling can make up for the decline of internal labor markets in part, but not entirely. Upward mobility for some people will be cut off.

The growth of the service industries does mean new jobs for Americans who can qualify for high-wage, high-skill positions in knowledge-based sectors like telecommunications, banking, and the professions—jobs that will coexist with the many low-skilled, low-paying openings that the economy has also been creating. The latter can be found, not only in the tertiary services, but in the knowledge-based sectors as well. The growth of the health services industry has meant many new jobs for food preparation, custodial, and laundry workers, as well as physicians, nurses, and laboratory technicians.

Because so many service jobs depend on demand based in other sectors of the economy—and ultimately on U.S. living standards—competitiveness and economic growth will remain essential for job creation at both ends of the pay/skills spectrum. To the extent that American firms move successfully into higher value-added services and goods, making possible higher living standards overall, Americans with jobs in the tertiary services will also be better off—at the least through broader opportunities. To continue moving into high-value-added services and goods, continuing investments in human capital will be essential; beyond this, American companies will have to utilize the skills and abilities of their employees effectively—a subject to which the next chapter turns.

Because direct exports (and imports) of services remain relatively small, the first-order impacts of trade and competition in the services on domestic employment are small. But trade pressures in manufacturing—and in many services that depend on manufacturing—have driven American firms to seek lower labor costs and greater flexibility in their labor forces. Companies in industries hurt by import competition—autos, steel—have slashed white-collar as well as blue-collar payrolls, laying off many people in service occupations. Domestic competition—driven in many cases by deregulation (most obviously in the airline industry)—has created similar pressures in service sectors.

For such reasons, companies in many parts of the U.S. economy have restructured to replace permanent employees with temporary and/or part-time workers. This is as true in the health care industry as in banking. With the spread of profit-seeking hospitals, health maintenance organizations, and specialized clinics (and because of changes in Medicare payments), hospitals have sought to tie staffing levels more closely to patient demand—by using temporary employees during peak periods, as well as contracting out food service and housekeeping. It is no longer true, if it ever was, that the typical part-time employee is the teenager with a job at MacDonald's, or the housewife who works a few weeks at Macy's to earn a little extra for her own Christmas spending.

As the examples above suggest, both domestic and international competition contribute to the rise in contingent employment. Table 40 compares typical labor force patterns in older, smoke-stack manufacturing companies—characteristic of the 1950s and 1960s—with those found in many service industries (as well as some kinds of light manufacturing). Companies seeking flexibility or pursuing new strategies through restructuring and automation (Macy's, New York Telephone, examples following in chapter 8) may redesign jobs so they can be performed by people with less skill and lower pay (cashiers replace retail clerks who once also helped customers choose merchandise). Self-service replaces semi-skilled jobs. Banks use part-time workers on Mondays and Fridays, their peak days. In other cases, two part-time jobs may take the place of a full-time position. As the next chapter illustrates, trade pressures and other competitive forces mean that many more American companies will seek to move toward a work force structured more like that on the right hand side of table 40.

Contingent employment transfers risk downward to the worker, who may not be covered by health and accident insurance, a pension plan, the other benefits that regular full-time employees have come to expect. By definition, contingent workers have little or no access to internal job ladders (and thus little opportunity for on-the-job training). Employers face fewer constraints regarding layoffs, hiring and promotion policies, job assignments and work rules. They can dispense to some extent with both the implicit and explicit contracts (i.e., agreements with labor unions, laws and regulations) that govern relationships with their full-time employees. This drive for freedom and flexibility, tied to the broad trends toward deregulation in the U.S. economy—and perhaps also to shifts in individual preferences—lies behind the growth in part-time and temporary employment in the United States.

Table 40.—Shifting Employment Patterns in the U.S. Economy

1950s-1970s	1980s
Large core work force of full-time, permanent employees, particularly in unionized manufacturing industries.	Growing contingent work force of part-time, temporary, and casual employees.
Firm-specific knowledge acquired through on-the-job training, plus seniority, meant steady advancement in earnings via the firm's internal labor market.	Portable skills—often acquired through formal education and training—replace firm-specific knowledge, as the external labor market replaces internal job ladders.
Flexibility for the firm through overtime and/or a buffer of full-time employees to meet variations in demand.	Flexibility for the firm comes through a smaller core of more highly skilled employees, coupled with contingent workers.
Examples: chemicals, steel, automobiles.	Examples: banking, retailing, health care, some manufacturing.

SOURCE: Office of Technology Assessment, 1987.

Relying on a buffer of contingent workers brings short-term savings. Just as some American companies have negotiated give-backs with labor unions—or established dual wage structures, with new entrants starting at lower levels than their predecessors—part-time and temporary workers can help hold down the bill for wages, benefits, and training expenses. On the other hand, the very lack of training, and of prospects for advancement, diminishes a firm's ability to make use of the human capital its employees bring to the workplace. When companies design standardized jobs that can be performed by temporaries in for two days or two weeks, they may be sacrificing efficiency both immediately and over the longer term. (The next chapter explores some of the less obvious reasons.) Over the medium term and longer—periods of years rather than months—companies that substitute flexibility in numbers for the flexibility created by a work force rich in experience-based skills and know-how risk losing their ability to compete.

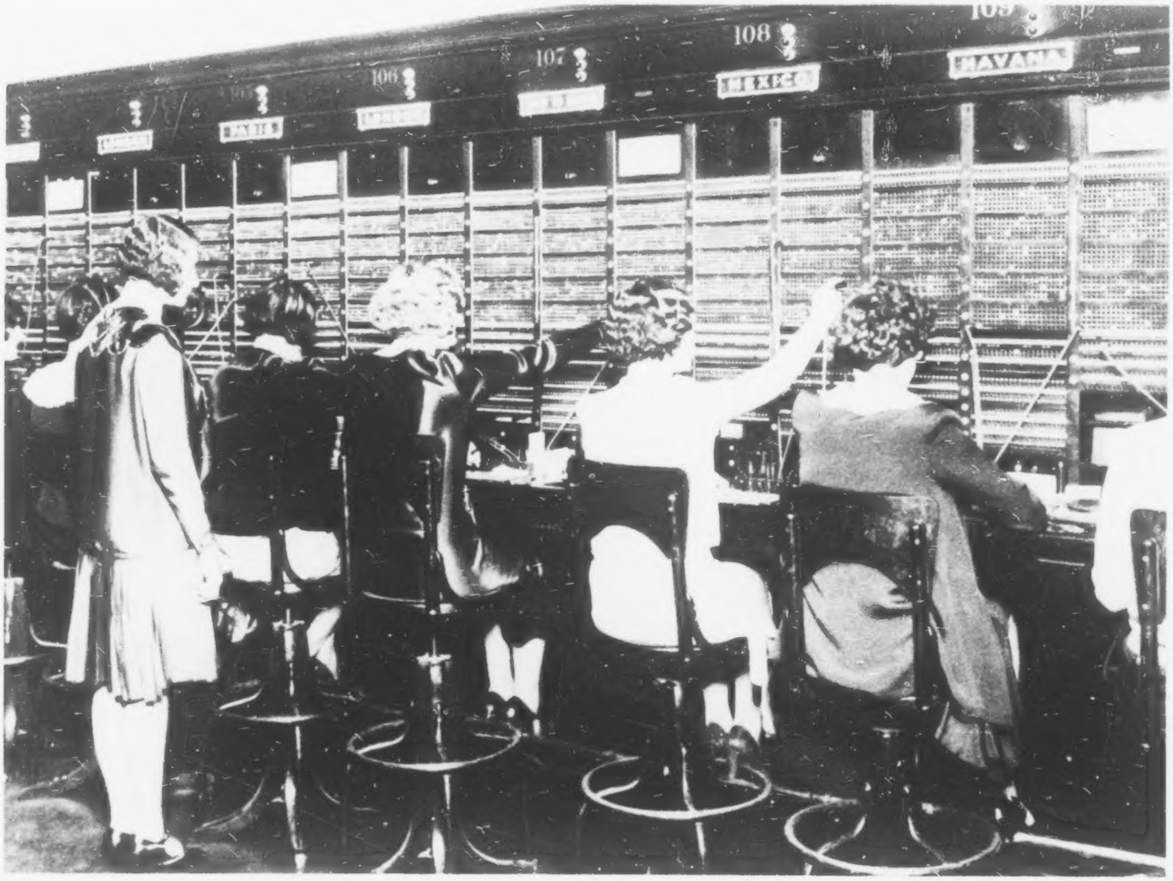

Photo credit: Smithsonian Institution

Chapter 8

Moving Toward a High-Skill Economy:

Computer Applications and Work Organization in the Services

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Chapter 8

Moving Toward a High Skill Economy:

Computer Applications and Work Organization in the Services

SUMMARY

The preceding chapter outlined the patterns emerging in the U.S. labor force over the past 15 years—a period during which manufacturing employment stagnated and began to decline while job opportunities in the services continued to expand. Some of the jobs created have been low-skill, low-wage positions in the tertiary services; others have been knowledge-based, with far better prospects for upward mobility and job security. Where possible, chapter 7 examined these trends quantitatively, in terms of numbers of people employed, their ages, educational backgrounds, earnings.

This chapter is descriptive rather than quantitative. In places it is speculative. The chapter explores work organization and computer applications in the services, asking: How does international competitiveness depend on skills and knowledge? How do companies make use of computer-based systems to enhance or to replace the capabilities of their employees? With 74 million people in the Nation's service work force, and some 38 million in the knowledge-based sectors, generalizations remain open to question. But conclusions do follow. To get and hold good jobs in the services, Americans will have to bring better knowledge and skills to the workplace. Public education will have to respond to new demands. Companies will have to provide better training, and do so on a continuing basis. In the knowledge-based services, employees at all levels will find themselves taking on more responsibility. And, while large numbers of relatively unskilled (and low-paying) service jobs will remain in the U.S. economy, many of these jobs will depend on prosperity created in part by knowledge-based services.

More often than not, technology in the services means applications of computer and communications systems. The knowledge-based services are in the midst of a transition from large and expensive mainframe computers, tended by experts, to distributed computing, used by everyone. The personal computer is only the most obvious sign of this transition. Yet before companies and their employees can come to grips with today's technology, new waves of hardware and software will arrive—making it much easier, for example, to link PCs with powerful mainframes, helping create far-flung integrated networks. People and organizations will have a hard time keeping up, much less planning for the future.

In many U.S. service firms, proprietary technologies—including computer applications—have become integral elements in competitive strategy. Isolating the contributions of proprietary know-how tends to be a good deal more difficult for service products than for tangible goods. Manufactured products can be inspected and tested, performance evaluated by objective measures, making it easier to judge relative contributions of proprietary technology, and—much the same thing—human capital. Chapter 3 illustrated some of these complexities for banking, chapter 5 for computer software; software is much the easier case because computer programs can be compared on a price/performance basis far more readily than banking services. But when the question becomes: Precisely why is one program better than another? answers can be hard to find. In the end, proprietary technology is a matter of judgment and experience more than well-codified knowledge. Individual expertise makes a difference; so do

group and social skills. Both the people in a company and their tools matter. When a company decides to buy a million-dollar software package from a vendor, its employees must select the right package; typically they will also contribute to design modifications that tailor it to the company's needs.

No one can specify with any precision *how* human capital affects competitiveness, although no one denies its importance. Much of this chapter focuses on applications of computers, because, for many years to come, this set of technologies will have enormous impacts on competitiveness in the services, and on the jobs and skills of people who work in service industries. At the micro level, work organization—how companies design tasks for individuals (e.g., data entry), and combine these tasks into groups (e.g., for processing financial transactions)—strongly influences the cost and quality of service. Some companies have sought to develop flexible systems for the delivery of services (and goods)—systems highly responsive to market demands (e.g., portfolios of mutual funds, among which customers can switch), as well as strategic applications of computing power such as on-line customer ordering, or corporate cash management systems. But cheap computing power also creates opportunities for rigid, mechanistic forms of automation (check processing in many banks, directory assistance from the telephone company). Sometimes improved competitiveness calls for flexibility, sometimes for cutting costs through rigid and tightly controlled forms of work organization. Obviously, a vast middle ground separates these two poles.

Over the longer term, strategic applications leading to new products, different services, and expanding markets will have greater impacts on international competitive standing than cost-cutting applications of computers. Some of these strategic applications will emerge at the micro level of individuals, work groups, and departments; they can be viewed in a work organization framework. Examples include Citibank's replacement of centralized transaction processing by a decentralized, product-oriented system—described later in the chapter. Other strategic applications must be viewed in organization-wide terms—often at the macro level of multinational integration.

Despite a shortage of concrete information on how computer applications and computer integration affect the competitive ability of particular companies, at either micro or macro levels, OTA's analysis suggests differences in approach internationally, which appear to translate into differences in competitive strength. At the micro level of work organization—integration of people and machines, rather than integration of dispersed corporate operations—many foreign firms do as well or better than their American counterparts. At the macro level of international integration, U.S.-based firms seem to be well ahead of their foreign competitors in the ability to link and coordinate the activities of divisions and affiliates thousands of miles apart.

American companies may spend more money on computers, but some foreign firms—particularly in Japan—use the money they spend more effectively. They scrutinize investment decisions for hardware and software more closely, and at more levels in the organization, invest more heavily in the training of their people, and operate highly developed systems for maximizing individual contributions to corporate goals. (These differences seem more evident in manufacturing than the services; Japanese service industries, with exceptions such as telecommunications and banking, appear relatively undeveloped compared to American industries—although this may simply be because analysts in the West have not focused as much attention on them.) Large Japanese corporations lag behind their American counterparts in the raw capability of their installed computer and communications systems, but use what they have at least as effectively. Moreover, concerted efforts in Japan to move toward an "information economy" (chs. 5 and 9) suggest that Japanese companies may begin to catch up in computer utilization during the 1990s.

At both micro and macro levels, current positions matter less than decisions being made today. These decisions—how to use computer and telecommunication technologies (which will depend in part on the capabilities of the people a company can hire, and on the training it chooses to provide)—will influence competitiveness 5, 10, 25 years from now. Managers face difficult decisions. A great deal of technology exists; many of the possible applications remain largely unexplored. As noted below, nobody knows the capabilities that artificial intelligence (AI) may bring to the workplace in the 1990s. The specialists who develop the systems tend to be interested in technology for the sake of technology, rather than in appropriate applications. Some companies plunge ahead, making investments and reorganizing work in the hope of establishing a competitive advantage, even though they may have no more than a hazy idea of the outcomes to be expected. Others move more slowly, sticking to what they know and understand. Sometimes one approach will prove right, sometimes the other.

Two examples—one at the micro level, one at the macro—illustrate the uncertainties. Today, many companies must ask whether AI, touted for 25 years, is finally ready to enter the workplace on a large scale. Expert systems intended to supplement people's skills have become one of the favored near-term applications. What should the prospective user—bank, insurance company, medical clinic—do? Invest its money, time, and effort now? Or continue to wait, at the risk of losing out to competitors who get a head start? At the macro level, the well-publicized strains between General Motors and its EDS subsidiary illustrate another set of problems. GM purchased EDS in large measure to get help in implementing its strategy of multinational integration (ch. 5). Since the acquisition, GM's management has come in for ample criticism. Some of it is no doubt justified, but the fact is that the task of putting together and learning to use a worldwide computer and communications network is enormously complex, the territory largely uncharted, mistakes inevitable.

Despite the confusion and uncertainty such examples hint at, the outlines of a new model of computer-integrated production have begun to emerge. The model fits some companies in both the services and manufacturing, but so far probably only a few thousand American firms in total. The common characteristic of these new-model firms is their combination of efficiency and flexibility. In the past, flexibility—the ability to respond to changing market conditions, to alter the firm's output or way of doing business (because of shifting consumer tastes, ups and downs in the business cycle, competitive pressures, new technological opportunities)—generally came at the price of efficiency. Flexibility meant labor-intensive operations. People are flexible, they can adapt. Machines, in the past, could not. The trade-off was a simple one: either a flexible organization, labor-intensive and relatively low in productivity, or an inflexible, mechanized production system. Mechanization brought higher productivity but also higher costs for adapting to change. What the computer brings is the potential (not always realized) for *both* productivity and flexibility.

Achieving both flexibility and efficiency places new demands on the labor force. Employees at all levels in new-model organizations must take on greater responsibilities. Integrated systems will put them in touch with more people, both inside the firm (colleagues in work groups, people in other departments) and outside (customers with problems or inquiries). Some kinds of work, in some companies, will be more fluid, less predictable. Some jobs will be upskilled; the people that fill them will need both broader and deeper skills—problem-solving and reasoning, social skills. Companies will rely on employees with these skills to compete. People will need these skills to get good jobs and keep them, to advance. New applications of computer and communication technologies mean new demands on the public education system; they will also mean new kinds of corporate training programs. At the same time, other jobs will be deskilled: the computer will make them simpler, more routine, less demanding, less interesting. Stratification in skills goes hand in hand with the stratification in wage levels and mobility prospects discussed in chapter 7. To keep job ladders and mobility channels open, the U.S. economy will need to continue creating large numbers of jobs at the high-skill end of the spectrum; policymakers will need to make sure the United States creates education and training systems that can prepare people for these jobs.

This chapter, then, suggests that a labor force rich in the skills needed for integrated production systems—in which applications of computer technologies enhance people's skills and contribute to organizational flexibility—will aid American firms in international competition, contributing to job creation and the Nation's standard of living. Indeed, *to compete effectively with economies having lower wages and living standards, the United States has literally no option but to create greater numbers of jobs in which computer and telecommunications systems enhance people's skills, helping them produce higher value-added services and goods.* This implies better education and training, especially for new entrants to the labor market and younger employees; a high-wage economy can only remain competitive through continuing investment in human capital. The alternative? Continued loss of ground to low-wage economies, followed by declining wages and lower living standards in the United States.

SERVICE JOBS AND MANUFACTURING JOBS

Preparing hamburgers in a fast-food restaurant has a good deal in common with assembly work in an automobile factory; the job of a white-collar clerk feeding forms into an optical character reader resembles that of a blue-collar employee tending a punch press in a metal stamping plant, or a kitchen worker loading food onto trays in a hospital. As such examples imply, the nature of a job may depend as much on work organization as on whether the job falls nominally on the service side or the manufacturing side of the economy. Indeed, viewed as encompassing skills, expertise, know-how, and work organization, technology becomes a major competitive weapon even in many of the tertiary services. The most casual observer sees the differences among fast-food restaurants. Each faces the same fundamental problem: defining a menu; managing a high-turnover labor force with limited skills and little job experience; dealing with a work load that fluctuates greatly during the day. How to organize production to give customers what they want, when they want it, while minimizing operating costs? Each chain has reached its own solution—a matter of proprietary technology in the sense of firm-specific knowledge and expertise, standardized procedures, training manuals. Some look more like production lines; others emphasize customer choice.

Differences between the services and manufacturing run deeper when it comes to jobs for professionals. In manufacturing firms, most of these people fill managerial and staff positions. They may supervise production in manufacturing, but in the services many professionals will be an integral part of the process; lawyers, surgeons, and teachers produce service outputs with their own minds and hands. In an accounting firm, professionals carry much of the responsibility for direct production; the accountants employed by a stamping company are no more part of the production process than the supervisors.

Despite such contrasts, numerous similarities emerge when comparing knowledge-based service jobs with high-technology manufacturing—the most obvious being applications of digital electronics to rationalize production, support managerial decisionmaking, and aid in design, development, and marketing. If some tertiary service firms depend heavily on proprietary technology, almost all those in the intermediate or knowledge-based services do. All financial service firms of any size, for instance, have had to develop the internal expertise needed to implement complex computer applications. Hartford Insurance Group employs well over a thousand programmers. Airlines that have developed their own reservation systems have reaped competitive advantages; with price competition holding down differences in fares, quick and easy bookings for customers who telephone directly, a well-established network of relationships with travel agents, and responsive service for major corporate customers count for a good deal. Note that an effective reservation system depends not only on computer hardware and software, but also on the airline's employees—their training, responsiveness, and commitment to their employer's goals. Everything else the same, the airline that makes customer service a genuine objective, and conveys that successfully to its employees, should be able to fill more seats than its competitors.

In many industries, knowledge and skills ultimately determine international competitive position; there is plenty of truth in the saying that investment bankers live off their wits. Regardless of industry, the capabilities that people bring to the workplace affect productivity and competitiveness: through technical skills, those of the software engineer or the computer repairman, loan officer or insurance underwriter; through managerial and administrative skills, those of the buyer in a department store, the branch manager in a bank, the foreman in a copper mine. The work may range from finding investment capital at the lowest costs, to planning new products, to lobbying government agencies. Sometimes the knowledge that matters is well-codified (as in the computer-aided engineering methods used to design a hydroelectric power station), sometimes tacit (as in the experience-based judgment that bank employees bring to the arrangement of financing for that power station). In all cases, the technology is developed by people, embodied in people's skills, transferred and diffused by people.

USING COMPUTER AND COMMUNICATIONS SYSTEMS

In industries like financial services, some computer applications simply automate portions of an existing production process. Other applications enable firms to create new service products, or provide existing services in new ways. Prentice-Hall now supplies its tax service, formerly delivered in loose-leaf form, on-line to law and accounting firms, as well as to corporate tax and legal departments.

New products can lead to new jobs. Whether they do or don't, they typically mean new skills and new learning for the existing work force. Appendix 8A, at the end of the chapter—a case study of restructuring at MetroBank (a fictionalized name)—illustrates. MetroBank's strategy required that customer service representatives (CSRs) actively sell a new line of products (e.g., credit cards, individual retirement accounts). In the process, the CSRs had to learn to use a redesigned and expanded computer system giving on-line access to customer accounts. Managers whose roles had been largely administrative had to learn to coach the CSRs, as well as to market the bank's services, including loans, to business customers. Moving into these new roles proved difficult, and sometimes painful, for both sets of employees. MetroBank's systems division, meanwhile, carried out its redesign of the computer network with little attempt to understand the CSR's working situation and needs, aggravating the difficulties. This bank's experience is not unusual; similar stories can be heard in other financial services firms and in other industries.

In some applications, the computer follows the same rules and procedures as the people it supplements or replaces: knowledge—once the monopoly of people with skills and experience—becomes embedded in the system. Box Z, which traces the evolution of automated claims processing in the insurance industry, describes how companies have put computers to work doing what people once did, faster and cheaper.

As box Z shows, work has changed radically for both clerical employees and claims adjus-

Box Z.—Claims Processing in the Insurance Industry[1]

Insurance companies began automating in the 1960s, installing computer systems for batch processing of high-volume but relatively routine claims—group health plans, automobile coverage. Labor intensity remained high through the middle 1970s, with clerks continuing to check and double-check the process at many points. These partially automated systems functioned as outlined below, using workers' compensation as an example:

1. Claims went first to an adjustor, who would verify the loss and the identity of the insured.
2. The adjustor then filled out an instruction sheet, by hand, got it approved by a supervisor, and sent the sheet to a typist who prepared a data entry coding form.
3. Each day, a batch of these forms went to the company's data processing center, where a clerk would pull a copy of the policy to check the coverage levels, then complete a different form and send it on to the keypunch department. If the policy were missing from the file—often the case—the clerk had to write to another office for a duplicate of the original rating sheets. A claims coder would then recode the policy before the claim could be processed and sent for keypunching.
4. After keypunching, the computer took over, printing checks to be mailed to claimants and recording payments. Processing took place in batches at night. Clerks continued to log each payment by hand. These logs were reconciled with the computer records once a year.

This process may seem complex, but others were more so; before paying a fire insurance or automobile claim, for example, an examiner would have to inspect the damage. Often, negotiations with other insurance carriers or with repair companies would follow.

Work reorganization in this industry has been driven by domestic competitive pressures (there is little international competition), with companies striving to cut costs and increase productivity in order to improve profitability and market share. Around the middle of the 1970s, insurance companies began to invest in on-line systems. Here, two alternative patterns of work organization have emerged, one with claims adjustors as end users, the other with most tasks performed by clerical employees.

- Where adjustors use the system themselves, clerks first screen and sort incoming claims. The adjustors investigate, authorize, and print settlement checks at their terminals, avoiding most of the intermediate steps of the older batch processing procedures.
- With clerical workers as end users, the software must contain decision rules that can dispose of the majority of claims. When a clerk at a terminal runs into a case that the system can't handle, she or he calls on an adjustor for help.

Productivity has grown enormously with both approaches, which differ in the ratio of more highly skilled adjustors to clerical workers, and in the intelligence built into the system.

Today, vendors market dedicated systems for health care claims that function as follows:

1. Incoming claims go directly to a clerk or assessor, who checks the form for completeness and assesses the claim (for coverage, contractual limits, reasonable and customary limits).
2. The operator calls up files with personal information on the insured (and may amend them), while the system creates windows that display allowable payments and explanatory codes (e.g., for physician charges, laboratory tests, drugs).
3. Using other windows, the clerk or adjuster can take account of co-insurance, catastrophic clauses, deductibles, and yearly or lifetime maximums.
4. A final window displays a draft payment form for the operator to verify or modify, and approve.

These systems not only issue checks automatically; some can prepare form letters with upwards of 2,000 variations. The system will automatically generate accounting and management reports that help the company predict claim frequencies and estimate its loss ratios. It can also track employee productivity. With insurance companies continuing to extend the capabilities of these systems, clerical workers (where they are

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[1] Adapted from "Draft Report: Insurance," prepared by B. Baran under contract for the OTA assessment, *Technology and the American Economic Transition*, pp. 49-54.

the operators) can handle two-thirds or more of all claims with no need to call for help from an adjustor.

The new systems eliminate coding, keypunching, and manual verification. With most of the repetitive and redundant tasks gone, opportunities for mistakes are fewer. So are opportunities to catch them. While some checks on accuracy can be built into the software, employees—whether clerks or adjustors—must take most of the responsibility for the correctness and completeness of their own work.

The next steps? A number of large automobile insurers have begun to give adjustors in the field portable PCs. By dialing into computers at a branch or main office, adjustors get the names and addresses of claimants to be contacted. They can print checks with their PCs. With almost all the work done remotely, there are no backups except those that can be built into the computer system.

tors in the insurance industry. Clerical jobs have grown more demanding, with people previously viewed as unskilled asked to take on many of the responsibilities of adjustors and assessors. While clerical jobs have been upskilled, pay has not changed much. The work of the remaining adjustors has also been upskilled. They get fewer routine cases; more of their workload consists of claims that the computer's built-in decision rules cannot handle.

In other commonly found patterns, it is the middle levels of knowledge and skill that become part of the system—leaving people with, say, data entry jobs at one extreme, and highly skilled tasks beyond the computer's capabilities at the other. In effect, work reorganization deskills some jobs while upskilling others. Eventually, many of the jobs like data entry will also disappear (because operators working at on-line terminals normally do this themselves).

As digital systems become still more pervasive (in many industries, their power has barely been felt), their influence on the organization of work still greater, both people and organizations will have to learn and adapt. This means designing applications that are well-suited to the skills, aptitudes, and motivations of the firm's employees, integrating their skills and abilities with those of the system—no easy task. Suppose, for example, that a multinational bank decides to invest in a computer network for linking its branches and subsidiaries. Viewed as a straightforward application of available technology, the critical skills lie in the design of the system: choice of equipment; when to use leased lines and when to rely on the public infrastructure; software for running the network. But viewed as a means for the bank to minimize financial risks and maximize profits, the problem is to develop a system with installed performance (as opposed to design specifications) that will meet the needs and complement the abilities of the bank's worldwide staff. Such a view helps clarify the difficulties involved: few if any of the bank's operating employees will understand computer networks; the system designers will not understand banking. Still, if the bank manages this task well, it may be able to capitalize on fleeting differences internationally of 1/32nd of a percentage point in interest rates. If it manages the task poorly, the network might be close to useless, and require extensive redesign.

Business Applications of Computer Systems

Over much of the 30-year history of computer use within business organizations, companies have simply automated existing tasks. Insurance companies began with batch processing of claims, as described in box Z. Banks learned to process checks more cheaply, helping them keep up with rapidly expanding transaction volumes. Businesses of all kinds automated routine functions such as payrolls to cut costs. Analytical applications such as computer-aided decision support for financial risk analysis came later.

Today, computing power is so cheap that its applications have become part of everyday working life for millions of Americans. New applications can be tailored to the requirements of upper managers and executives (work stations for the corporate treasurer). Companies can use computers to regulate and monitor routine production (as in the well-publicized cases where telephone operators find their work overseen by call-monitoring systems).[1] Some people find themselves with jobs that are more challenging and perhaps more rewarding; others find themselves part of a mechanized system little different from a 1930s-era assembly line except for the computer at its heart.

In the early years, as computers began to proliferate, corporate data processing (DP) departments with professional staffs took most of the responsibility for selecting hardware and software, particularly in the larger firms that pioneered back-office applications in banking and insurance. Smaller businesses began purchasing systems during the latter part of the 1960s, as prices dropped.[2] Applications broadened well beyond the accounting and records-keeping packages that had been on the shopping lists of most first-time business customers. Digital equipment also began turning up on the factory floor for industrial process control.

The centralization of the early years started to wane during the late 1970s—a result of distributed processing, friendlier systems, and, a few years later, the spread of personal computers. With perhaps 8 million PCs in use in American businesses—half as many as have been bought for home use, and a penetration that remains below 15 percent—massive new waves of expansion and technological change lie ahead (box AA).

Business purchases of PCs, along with continued progress in networks and distributed computing, have helped destroy the monopolies that centralized DP departments once enjoyed in American corporations. With large firms moving toward decentralized information utilities, a few have even converted their DP centers to employee training facilities. Although some companies continue to write their own software, standardized applications packages have taken over much of the corporate market in the United States (ch. 5). When vendors like McCormack & Dodge and MSA sell integrated software for accounting (general ledger, accounts payable and receivable, fixed assets, personnel and payroll, purchasing, inventory management), there is no longer much point in a firm putting its own programs together.

The need today? Software and systems applications for strategic purposes. Most firms that operate on an international scale have already achieved many of the savings possible through automation of existing functions. The next wave of applications will help them deliver goods and services to customers more effectively. American Hospital Supply, to take one example, has linked its computers with those of hospitals and clinics, which can now place their orders electronically. In such cases—i.e., if a firm can establish a competitive edge with a unique software package—internal development may still make sense.[3]

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[1] See, for example, M.W. Miller, "Computers Keep Eye On Workers and See If They Perform Well," *Wall Street Journal*, June 3, 1985, p. 1; W. Serrin, "More Workers' Terminals Are Staring Back," *New York Times*, May 14, 1986, p. B8.

[2] See, for example, Appendix C, "Computers: A Machine for Smaller Businesses," *International Competitiveness in Electronics* (Washington, DC: Office of Technology Assessment, November 1983), pp. 531-535

[3] Some companies have also chosen to market software originally developed for their own use, as a new line of business or to recoup some of their development costs. Accounting firms like Arthur Anderson and Peat, Marwick, Mitchell have been marketing software packages to their customers for years, as have a number of investment banks—E.D. Myers, "Big Eight V. ADAPSO?" *Datamation*, Jan. 1, 1986, p. 32; P Hodges, "Do the Big Eight Add Up?" *Datamation*, Feb. 15, 1987, p. 63.

Salomon Brothers, for another example, offers software for economic forecasting and equity screening; originally developed to support their in-house investment management operations, outside sales have been directed at institutional investment managers. Manufacturing firms including Westinghouse, Standard Oil, Republic Steel, and Boeing have established subsidiaries for marketing software (or computing services) to other companies. Boeing Computer Services sells time on its Cray X-MP supercomputer. A telecommunications link between Boeing's offices in England and the United States gives engineers at Britain's National Nuclear Corp. access to a simulation program originally developed by Lawrence Livermore Laboratory for the U.S. Department of Energy. The program predicts the consequences of failures in the cooling system of a nuclear powerplant. See "Boeing Draws on Its Years of Experience," *Financial Times*, Oct. 14, 1985, p. 12.

Box AA.—Technological Advances in Computing Systems

In the services, computer and telecommunications systems do two fundamental kinds of things:

1. provide error-free management, manipulation, and transmittal of almost unimaginably large volumes of data and information (the primary sources of error will normally be at the input end, except for software bugs and system design flaws); and
2. solve mathematical (and logical) problems previously intractable, leading to new analytical tools (expert systems for decision support) and real-time control models for production processes (optimization of message traffic in a telecommunications network).

Over the medium term of 5 to 10 years:

- Businesses will continue to invest heavily in distributed systems and dispersed computing power, with cheap machine intelligence and inexpensive mass storage available in many locations (through local and wide area networks, LANs and WANs—ch. 5).* Half or more of major U.S. financial services firms expect to have expert systems installed on at least an experimental basis by 1990. (One result will be to begin a new wave of deskilling in banking.)
- Companies will use these distributed computing systems for manipulation and communication of text and graphics, as well as quantitative data, the system becoming a telecommunications network and information storage device as much as a calculating machine. This evolutionary change will culminate in the widespread availability of ISDN services.
- The growing range of inexpensive, off-the-shelf software for small machines will enable people without specialized training to use computers for routine applications that go well beyond the word processing and bookkeeping common today. Examples include desktop publishing and much more powerful graphics packages. While falling prices for hardware lie behind the explosive growth in computer applications in business and industry, it is software that determines what computers can ultimately do.

The early expert systems for banking will be expensive. Standardized software packages for PCs are cheap. ISDN will be a massive and costly undertaking. The point is simply to suggest something of the directions and scope of technical change. Within the next few years, still less costly mass storage on optical discs will provide a major boost for business applications. Somewhat further ahead, corporate users should be able to begin making extensive use of AI, and, perhaps, natural language processing. Where very large data bases and fourth-generation languages combine to overload the largest current business-oriented systems, some companies may turn to supercomputers.

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*Of 40 multinationals surveyed for OTA, more than 80 percent had introduced or were planning to install LANs, with office automation the most common initial application—"Data Processing in Multinational Corporations," draft prepared for OTA under contract No. 533-6410 by Mackintosh International Ltd. This survey, which forms the basis for portions of the analysis elsewhere in the chapter, covered multinational corporations (MNCs) with headquarters in the United States, Europe, and Japan (16 American, 16 European, and 8 Japanese). Seventeen companies were primarily service suppliers; the rest did most of their business in manufacturing.

The survey found that many managers, somewhat at sea with the possibilities of computer-based systems, feel there is too much new technology to successfully understand and utilize. Not only do managers and lower level employees who feel intimidated or threatened by the new technologies resist learning about them, but many executives seem confused over the economic benefits. The MNCs most comfortable in this environment tended to be those already quite familiar with the new technologies, either because they produce them or because they have lengthy experience as users (computer manufacturers, aerospace companies, large financial services firms).

On expert systems in financial services below, see ch. 3; on ISDN (Integrated Services Digital Networks), see chs. 5 and 9.

Motivations: Cost Control and Strategy

Multinationals expand and improve their computer and communications networks to cut costs and/or pursue new business strategies. Their expectations may or may not be met; in many cases, system performance fails to live up to expectations—or, putting it another way, the impacts on cost structure and competitive ability differ from those anticipated. Often, no more than a hazy idea of future benefits will be possible in advance. This was probably the case with IBM's venture into a unified worldwide engineering and manufacturing database during the early 1970s—an undertaking that evidently proved far more time-consuming, costly, and painful than the company anticipated. With the focus shifting toward providing new services and entering new markets, risks will go up because failure may endanger a company's strategy as well as its cost structure. But to the extent that strategic applications work out as planned, the company may benefit in indirect ways, hard to capture with conventional accounting measures. For instance, a firm may be able to create new forms of customer loyalty.

In the United States, particularly in contexts such as computer-aided manufacturing, investment decisions have frequently been criticized as short-sighted, most commonly on grounds that managers fail to anticipate and account for some of the potential benefits.[4] The crucial decisions generally concern pace and priorities. How fast should the company move into expert systems? Which links in a planned global computer network should be installed first? If nothing else, such questions point to the broad gray area separating investments made to control costs (where paybacks can be estimated in straightforward fashion) from those undertaken for strategic reasons (where uncertainty will be much greater).

Current priorities for strategic applications in the services include on-line access to customer records for tracking shipments and handling inquiries, and database applications for marketing, along with electronic customer ordering.[5] Banks and financing companies have begun using interactive systems to prepare home mortgage agreements. Hotels provide automated check-in/check-out services. Securities dealers supply major customers (e.g., pension funds) with terminals that not only display quotations but enable the customer's traders to execute buy and sell orders.

Table 41 lists other examples of strategic applications. These have been divided into two categories, corresponding to the distinction between micro and macro levels of integration treated in more detail in the next section. Briefly, computer integration at the micro level has its primary impacts on individual and group tasks; a work organization perspective becomes appropriate. The macro level of integration refers to linkages among departments, divisions, and affiliates, as well as to linkages among firms; an organizational perspective will generally be most useful.

Computer links between firms are not new. Airbus Industrie, the international joint venture, relies on computer networks to coordinate engineering design and development, as well as production. Earlier chapters described the SWIFT banking network, along with air travel reservation systems that interconnect airlines and travel agents. But in recent years interfirm computer links have been expanding more rapidly, with ramifications that have yet to be explored. Certainly these implications seem to differ from those of telephone or postal communications. Netting arrangements among gasoline suppliers, for example, suggest that the computer systems of major oil firms may be more closely coupled with one another than with those of their own wholesalers and dealers, or pipelines and refineries.

Some analysts have argued that, at the most fundamental level, corporations evolve to minimize transaction costs—basically, the costs, most of them indirect and less than visible, associated with moving, manipulating, and otherwise making use of information.[6] Continuing

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[4] See, for example, G.J. Michael and R.A. Millen, "Economic Justification of Modern Computer-Based Factory Automation Equipment: A Status Report," *Annals of Operations Research*, vol. 3, 1985, p. 25. Of course, accounting calculations sometimes serve simply to validate decisions made for other reasons.

[5] For example, a French chemical manufacturer permits customer access to the chemical firm's own database for placing orders and tracking shipments. A chemical company based in the United States has installed PCs at the water treatment plants it supplies; the PCs are linked to a host computer for automatic ordering and billing. In the future, the host machine will be directly linked to process control computers in the water treatment plants. These examples come from "Data Processing in Multi-national Corporations," draft prepared for OTA under contract No. 533-6410 by Mackintosh International Ltd. Imperial Chemical Industries, a British company, likewise plans links with 100 of its customers by the middle of 1988 using a commercial value-added network—"ICI Set To Forge Data Exchange Links With Its Customers," *Financial Times*, Apr. 23, 1986, p. 10. Not only purchase orders and invoices, but shipping forms and requests for quotes can now be handled over the electronic grid. Electronic payments may follow. The American National Standards Institute has been working on a generic electronic order form that firms could use regardless of industry—A. Pollack, "Doing Business by Computer," *New York Times*, July 10, 1986, p. D2.

[6] See, for example, O.E. Williamson, "Transaction Cost Economics: The Governance of Contractual Relations," *Journal of*

Table 41.—Examples of Strategic Applications of Data Processing and Communications Systems

Computer integration at the micro level:

- An American manufacturing firm coordinates customer service calls based on a set of software rules that assign priorities dynamically to the queue of requests.
- A West German bank, which introduced a home banking system in 1983, makes customer account records available on-line to its sales and marketing representatives through 4,800 terminals. (The advantages are greater than for an American bank because German banks can hold and trade in securities for their clients.)

Computer integration at the macro level:

- Customers can call a fast-food chain's 800 number for home delivery. A network of regional centers distributes the orders among local outlets on the basis of work load as well as proximity to customers. The chain has equipped 10,000 delivery trucks with hand-held computers to help reduce paperwork, and uses a nationwide database of demographic information when planning and promoting new products.
- A diversified Japanese MNC provides all of its upper managers with on-line access to the corporate database on production, pricing, and sales. Experience so far has shown that some of the managers access the database hundreds of times per month, others hardly at all.
- An American-owned book wholesaler uses point-of-sale terminals to automate ordering, provide stock control, and speed response to customer orders.

SOURCE: "Data Processing in Multi-national Corporations," draft prepared for OTA under contract No. 533-6410 by Mackintosh International Ltd.

technological developments reduce transaction costs both within firms and among firms. If the new systems alter or shift transaction costs sufficiently, quite dramatic changes in organizational form and business practice could result, with major impacts on international competitiveness. Note that such outcomes need not depend on large direct savings in easily measured cost categories. Realignments among firms and industries could result from indirect or less visible effects of computer-based technologies. For example, shared computer networks will make communications between firms both easier and more easily hidden. Will information sharing lead to collusion and other forms of anti-competitive behavior?

Already, Chrysler Corp.'s suppliers can tie their computers into the automaker's engineering/manufacturing network, or use terminals supplied by Chrysler.[7] GM's planned worldwide data processing and communications network will also link thousands of suppliers, as well as GM offices and plants. Chrysler and GM share many of the same suppliers. These suppliers may also sell to Ford and Toyota. Indeed, Ford and Toyota may sell components or subassemblies to Chrysler and GM. How far will integration of the various systems go? From a technical standpoint, the growing consensus around GM's Manufacturing Automation Protocol suggests that mutual compatibility will be the eventual outcome. If so, what will the consequences be, if any, for competition, nationally and internationally? At the least, such possibilities pose new questions for antitrust policy.

Integration: Technical and Organizational Dimensions

By now, many companies in advanced industrial economies have enough experience with computers, peripherals, communications links, and software to regard them as standard tools of business practice. But if familiar, hardware, software, and their applications have grown up independently of one another, and often remain incompatible. Equipment from different manufacturers may not be able to communicate. Users in different parts of a company often make differing technical and organizational choices.

Integration at the Macro Level

Worldwide integration requires effective communications among people who may be thousands of miles apart. Firms with managerial responsibilities dispersed to many locations need systems that can provide effective communications both horizontally and vertically (figure 48). Typical applications include:

- finance (reporting by divisions and subsidiaries; consolidation of accounts; manage-

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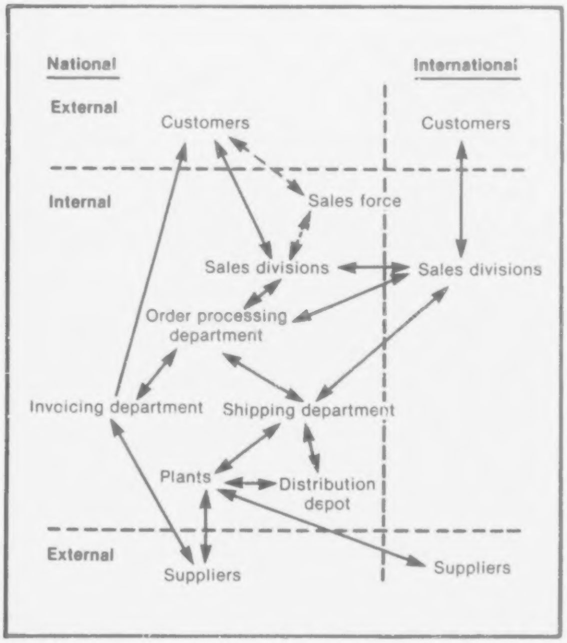
Law and Economics, vol. 22, 1979, pp. 233-261; M.E. Casson, "Transaction Costs and the Theory of Multinational Enterprise," *New Theories of Multinational Enterprise*, A.M. Rugman (ed.) (London: Croom Helm, 1982), pp. 24-43.

[7] "Productivity, Quality and Profitability Through Emerging Technologies," *Automotive Engineering*, March 1986, p. 52. The Chrysler system, centered on 28 large processors, includes more than 1,100 terminals, about half for computer-aided design and manufacturing.

Figure 48.—Intra-Corporate Information Flows



SOURCE: Mackintosh International Ltd., under contract No. 533-6410 to OTA

ment of both short and long term financing, including international diversification of risk and cash management);

- marketing and distribution (coordination of advertising/marketing strategies; processing of orders; inventory management; pricing; shipping);
- R&D, product design, and production control (international coordination of R&D projects; computer-aided design and manufacturing or CAD/CAM databases, including customization of products for particular markets; production planning and scheduling, including change notices, quality control records, and inventory control for purchased inputs as well as final outputs);
- administrative and clerical (electronic filing; messages and mail; employee travel arrangements).

Many companies began with financial reporting, but as multinational manufacturers gained experience with international data networks, more of their internal traffic has dealt with planning, production control, purchasing, and sales.

During the 1970s and early 1980s, large corporations often put together separate networks for marketing, engineering (perhaps including production), and administration. In many cases, these networks, with beginnings in different places at different times, remain incompatible; IBM currently operates five or more (table 42). American Express maintains separate databases for its regular and gold cards.

Integration in a technical sense suffers when one piece of hardware cannot talk to another, and when software developed for one computer will not run on others. Integration in an organizational sense suffers when people in different parts of the corporation with related jobs continue to work with different systems. In the past few years, managers in Japan and Europe, as well as the United States, have begun seek-

Table 42.—IBM's Intra-Corporate Computer Networks

Network	Function
Professional Office Support System	Worldwide electronic mail linking 290,000 of IBM's 400,000 employees.
Digital Communications System	Radio-based system for 20,000 field service repair engineers in the United States, each of wnom has a hand-held computer for communicating with a dispatch center, getting technical guidance, checking on the availability of parts, and billing customers.
Remote Technical Assistance Information Network	Links 40,000 engineers in 62 countries, primarily for troubleshooting.
Hands-On Network Environment	Sales and marketing system for 25,000 employees.
Administrative Access System	Ordering and payroll for 35,000 employees.

SOURCE: D. Kneale, "Sharpening An Edge," *Wall Street Journal*, Nov. 10, 1986, p. 38D.

CHASE BANK BY PHONE
CHASE BANK BY PHONE
CHASE

Photo credit: Chase Manhattan Bank

Large American banks maintain offices in dozens of countries.

ing to reduce these incompatibilities and to more effectively integrate computer applications into ongoing operations. While capital costs will be high, many MNCs have decided the time has come when the benefits of greater system integration (including lower operating costs) will outweigh the investment costs.

While desirable in principle, technical integration—so that equipment can communicate easily, software run on different machines—promises to come slowly at best. Suppliers differentiate their equipment for marketing as well as technical reasons. So long as centralized batch processing was the rule, few users made compatibility a high priority; they simply picked equipment for a given, specific purpose. As a result, most users now have substantial investments in incompatible hardware and software, inventories that have grown piecemeal over the years. The fast-food chain MacDonald's, for example, operates computers from half-a-dozen manufacturers at its headquarters alone, none of which can communicate with the others.[8]

The choices of hardware and software a firm makes as it seeks to integrate its computer systems will depend on the company's existing lines of business and strategy, but will also help shape the firm's *future* structure. Horizontal/vertical integration may be encouraged or discouraged. Product lines and manufacturing technologies of certain kinds may be favored. Employees with certain skills will become more or less valuable.

If many of the corporate networks operated by U.S.-based multinationals remain independent and incompatible, American firms nonetheless seem to be ahead of their foreign competitors at macro level integration.[9] They have invested more heavily in wide area networks, and use them more extensively and effectively. This lead holds both in high-technology manufacturing (commercial aircraft, computer hardware) and in services (banking, insurance).

U.S.-based service firms have generally moved further toward integration in a technical sense (e.g., standardizing on network protocols and software packages) than either European or Japanese MNCs. Nonetheless, the decentralized management typical of American companies, while creating an environment in which innovation can flourish, often leads to differing technology choices across departments and divisions, as well as across countries. In contrast to American firms, operating divisions in Japanese corporations have less autonomy in deciding on computer applications. Companywide standards are more common; greater effort goes toward searching for consensus on how to implement computer-based automation. Japanese companies are slow to adopt computer and telecommunications technology, and have lagged in putting together integrated multinational organizations (as noted elsewhere, their strategy in manufacturing has generally been to export from Japan unless or until forced to invest abroad). But at the micro level of work organization, their careful and cautious approach has served the Japanese well, at least in manufacturing industries.

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[8] Besides specialized work stations from several vendors, the company has general purpose machines built by IBM, Tandem, and AT&T, plus Wang word processing equipment—J. Rippeteau, "Enter the Intelligent Telephone Line," *Financial Times*, Apr. 4, 1986, p. 12. Note that many computers cannot communicate even if built by the same manufacturer.

Ch. 5 included other examples of incompatibilities among systems, and the growing impetus for integration and commonality. Many MNCs view their compatibility problems as serious already, and bound to get worse before they get better. In general, a company that imposes compatibility standards will face greater expenses in the short term because different departments may not be able to choose the low-cost system for their particular needs. Multinationals that have grown by acquisition face particular problems in terms of compatibility, but lack of international standards for hardware and even more for software makes integration a long-term goal for everyone. Chs. 9 and 10 illustrate some of the problems from the standpoint of international agreements on technical standards.

[9] "Data Processing in Multi-national Corporations," op. cit. Decentralized American companies experiment more with new data processing and communications technologies. European multinationals tend to be behind U.S.-based MNCs in technology and behind Japanese MNCs at micro-level integration of people into the system

Integration at the Micro Level

U.S.-based MNCs tend to be ahead of their Japanese counterparts in the use of the most advanced hardware and software. But it seems clear that the Japanese are well in the lead when it comes to manufacturing systems that effectively integrate people and machines—matters of task design and work organization more than choice of equipment.[10] This has been a major source of competitive success in industries including automobiles and microelectronics. One indicator: the ability of Japanese firms to achieve higher yields and higher quality in the production of large-scale integrated circuits while using the same equipment as American firms.

The consensus-building mechanisms that have left some Japanese corporations behind in multinational integration here give them advantages: their *ringi* decisionmaking processes lend themselves to conflict resolution and the development of shared values, necessary attributes of integrated systems at the micro level (for reasons discussed in the next section). In general, large Japanese companies also invest more in human capital than their American counterparts—e.g., in corporate training and retraining programs. Thus far, however, there is little evidence that Japanese *service* firms gain competitive advantages through better integration of available technologies into ongoing operations.

The question then becomes: If large Japanese manufacturing companies get a competitive edge through their ability to design and manage integrated production systems, will Japanese service firms eventually do the same? OTA's analysis suggests that they will, although the relative immaturity of many Japanese service industries means that it may take 10 or 15 years.

Over the medium to long term, Japanese companies should be able to successfully adapt their consensus-based organizational traditions to production processes characteristic of the knowledge-based services. Japan's push into software and fifth-generation computer systems, discussed elsewhere, indicates high levels of resolve in both government and industry. As they have done in the past in manufacturing, Japanese companies will probably be able to avoid some of the mistakes made by pioneering U.S. firms. If today their hardware and especially their software remains well behind that found in American service firms, there seems little doubt that Japanese companies will eventually make good technical choices, and arrive at production systems well-suited to the characteristics of their labor force.

SYSTEMS DESIGN AND PEOPLE'S SKILLS

Data processing and communications systems in all their variety place new demands on the people who use them. Ideally, of course, both hardware and software would be developed with the needs and abilities of users in view. But the ideal is seldom approached, given the pace of technological change, the foibles of designers and their fascination with technology for its own sake, the universe of alternative system architectures permitted by the many component and subsystem choices. (See, for example, the section entitled "Technology" in the MetroBank case study, app. 8A.)

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[10] See, e.g., *International Competitiveness in Electronics*, op. cit., chs. 6 and 8.

Technical capabilities impose one set of constraints. Some things are possible, some are not; some expensive, some cheap. Managers at a distance from the workplace may impose their own constraints. Who, then, actually designs computer-automated jobs? In most cases, technical experts have more control than any other group, simply because they are the only ones who fully grasp what can be done. Given their monopoly on technical knowledge, the experts —including those who work for vendors and suppliers—have a great deal of influence over the perceptions and expectations of everyone else. Sometimes the experts or the managers consult the people who will have to use the system, sometimes they don't. In many cases it seems safe to say that, when it comes to the design of work, as opposed to the design of the system in a strictly technical sense, no one is in charge.

In such a setting, job requirements evolve, often with a great deal of trial and error. Despite confusion, uncertainty, and mistakes, large and small, new patterns in the use of computer-based systems have begun to emerge in American industry—albeit patterns that are not yet sharply defined. Flexible product development and production systems, in the extreme verging on customized production, have become primary objectives for businesses operating in shifting and unstable environments, domestic and international, in service industries and manufacturing.

Flexibility means different things in different contexts, but first and foremost implies rapid response to shifting competitive circumstance:[11]

- tailoring product attributes in response to changing patterns of demand, or to create changes in demand (the sport shoe example in ch. 5);
- thrusts into new geographic or product markets (interstate and offshore banking, the home equity lines of credit spurred by changes in U.S. tax law);
- new products made possible by new technological opportunities (on-line information services);
- shifts in operating level or product mix, as a consequence of business downturns or new competition (American automakers, hit hard by Japanese competition in the early 1980s, sought to drive down their break-even points, enabling profitable operations at lower production volumes);
- changes in government policy (leading, for instance, to new opportunities for service firms that provide hazardous waste disposal).

Plainly, technology itself is part of the problem; technical change comes more rapidly than ever before, and firms in many industries find it hard to keep up. But technology is also part of the solution. The ability of an organization to respond to change depends on its store of technical knowledge, on how well its employees can use the tools available—whether these are developed internally or purchased in the marketplace.

Sometimes competitive circumstances call for computer systems that replace peoples' skills, sometimes for applications that enhance peoples' skills. In the first case, typified by transactional applications emphasizing cost control and illustrated by (most of) the insurance claims processing examples in box Z, the automated process is a relatively mechanical one; the system does more or less what people once did. (Box C in ch. 1 distinguishes between transactional and analytical applications of computer systems.) Back-office paper processing in banks provides another set of examples. In the services, semi-skilled clerical employees are generally the first to find their jobs deskilled or given over to the system.

The second case, enhancement of people's skills—illustrated by the ways in which MetroBank's CSRs can use their terminals—includes both analytical and strategic applications. Here the computer helps people do things they could not do before—e.g., interpret signals from a CAT scanner—or helps them do things faster or more easily. Giving employees in the front office of a bank on-line access to customer records creates a new menu of organizational opportunities. Their work now an intrinsic part of the firm's marketing strategy, MetroBank's CSRs had to acquire a new set of skills. This entailed much more than learning to use an "information utility." The greatest changes were attitudinal—learning to actively sell the bank's products. The new demands on the CSRs were part of a much broader set of shifts, as MetroBank tried to alter its culture—in part to cope with uncertainties posed by deregulation. With new job requirements and new learning come better career prospects, should the CSRs wish to take advantage of them (some do not).

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[11] Students and practitioners of management, along with critics, periodically rediscover the virtues of flexibility. Simon, writing more than 20 years ago, covers much the same ground as those in the 1980s who call for flexible organizations and customized production as remedies for the competitive dilemmas of American industry. See, for example, H.A. Simon, *The Shape of Automation* (New York: Harper & Row, 1965).

On flexibility in manufacturing, including applications of robotics, see *International Competitiveness in Electronics*, op. cit., pp. 233-246.

Other examples from banking include decision support systems incorporating economic models for use in judging lending risks. (How will falling oil prices affect a small, independent gasoline distributor's business?) Again, the computer system enhances people's skills—here people who will probably have professional skills to begin with. To take a different example, when computer-aided drafting replaces manual drawing in architecture, engineering, and construction firms, productivity goes up, sometimes by factors of 10 or more. Beyond the direct impacts, designs can be changed more easily and more quickly; the computer can estimate construction costs for alternative designs, prepare bills of materials, estimate heating and cooling loads, prepare perspective drawings in sun and shadow. Designers can explore more options. Clients can pursue them in greater depth. The design firm has greater flexibility: it can respond more readily to customer needs and desires, pursue new kinds of business. (Somewhat paradoxically, another result of computer-aided drafting is likely to be greater standardization; the computer can store and recall design features from a library, for the operator to put together more or less mechanically.) But while the automated system opens up new avenues for the designer, it takes over many of the manual skills of the draftsperson. Jobs for drafters are deskilled. Companies with these systems commonly hire people with vocational-technical schooling but no more than, say, a year's manual drafting experience. They feel that those with longer experience will be overqualified (and perhaps overpaid), and unable to adapt as well.

Photo credit: Cincinnati Milacron Corp.

Work station for computer-aided design.

As the drafting example suggests, computer applications in the services lead to the deskilling of some jobs and the upskilling of others. The patterns can be complex and confusing, with many exceptions, but the empirical evidence indicates that upskilling will be more common where people already have good skills and good educational credentials. Other jobs tend to be deskilled.[12] Computers spread know-how through an organization, making it available to many more people, raising the average skill level at which employees can operate, and helping to preserve and maintain knowledge;

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[12] For a summary, see P. Flynn, "The Impact of Technological Change on Jobs and Workers," final report to Department of Labor, Office of Employment and Training, 1985. Also *Technology and Structural Unemployment: Reemploying Displaced Adults* (Washington, DC: Office of Technology Assessment, February 1986), pp. 335-354.

in the process, they make some people, and the skills these people have, redundant.

The implication is straightforward but daunting: American companies and American education and training institutions will have to do a better job of preparing people for high-skill jobs. Plainly, many Americans will continue to fill low-skilled, dead-end jobs. But jobs in tertiary services like retailing, hotels and restaurants, and recreation depend on the size of the Nation's economy, on living standards, and in some sense on international competitiveness. Expenditures on health care, entertainment, and vacation travel go up with levels of affluence; most people would prefer jobs at Bloomingdale's to jobs at K-Mart. The more high-skill jobs the U.S. economy can create, the more work of other kinds there will be. This section, then, touches on the nature of skills themselves, before going on to the ways in which companies use the skills of their employees. (Ch. 10 treats the implications for human resources policies.)

Well-defined skills characterize some professions, vocations, and occupations, but the notion of skill remains fuzzy and ambiguous beyond rudimentary levels. Box BB touches on some of the reasons. Reading, writing, and arithmetic as taught in schools are skills. So are reading critically, writing incisively, and thinking quantitatively (along with learning itself)—but these are much harder to pin down or to teach. And at higher levels, as Polanyi points out so aptly, skilled people "know many more things than they can tell."[13] Schooling, of course, also conveys the rudiments of workplace discipline—showing up on time, tolerating if not respecting authority. Along with their other objectives, schooling, apprenticeships, and training programs help people learn to deal with co-workers, customers, and clients.

The better a firm uses the skills and knowledge of its employees, the more competitive it can expect to be. There is more to this than grouping tasks as if they were building blocks, just as there is more to computer applications than distinguishing between replacement and enhancement of people's skills. But from the perspective of the system and how it functions, two extremes in the design of work can usefully be distinguished. At one extreme—when the computer is used in more-or-less direct fashion to automate what people once did—the system will be rule-based and mechanistic. The "program" is a rigid one, procedures formalized, mass production—of insurance claims or Model Ts—the objective. At the other extreme, where product and process characteristics vary and flexibility becomes a buzzword, the organizational program must vary too. This, of course, is one of the things computers are good for: flexible rather than fixed automation. Software can be written to accommodate variation, new programs loaded as needed. On the left axis in figure 49 (which is identical to figure 6 in chapter 1), the two extremes have been labeled adaptive and rigid, suggesting the difference between a system that can adjust dynamically to its environment—even if that environment is shifting and unstable—and one that can change only slowly.

Figure 49 suggests how various industries and enterprises might be characterized in terms of work organization and computer utilization. Where a firm belongs will depend on patterns of computer use among the occupational groups in its work force. Table 43 provides a general framework. The table breaks occupations down into two major categories: those in which computer systems have not (yet) had substantial impact on work and skills (the first 3 of the 11 occupational groups); and those where utilization of computer systems in the production process is common and helps define the nature of the work (the remaining 8 occupational classes).

Organizations with limited and/or routine use of computers tend to cluster at the left in figure 49, some characterized by rigid forms of work organization (fast foods), others by more adaptive forms (real estate). Most of the jobs in such organizations would fall in occupational categories 1-3 in table 43, with some perhaps in 4-7 (extensive but routine computer use).

A second major cluster of enterprises, at the top right, consists of those in which computer

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[13] M. Polanyi, *Personal Knowledge* (Chicago, IL: University of Chicago Press, 1958), p. 88.

Box BB.—Tasks, Jobs, and Skills

Even "unskilled" workers must possess a wide range of very real abilities, including some degree of problem-solving skill. They must get along with co-workers, conform to the discipline of the workplace. Literacy may or may not be necessary, but communication certainly is. Skilled workers rely on broader and deeper stores of tacit know-how (anticipating problems, troubleshooting, generalizing from a limited number of cases), along with well-codified knowledge (how to use DO statements in Fortran programs). Most professionals depend heavily on book learning, but need tacit knowledge and good judgment as well —skills that go far beyond knowledge acquisition and reasoning.

Some tasks are simple and fixed, repeated in the same sequence every few minutes or few seconds. This is the case for much unskilled and semi-skilled work: data entry, collecting bridge tolls from motorists. Skill levels go up as judgment and experience come into play: supermarket checkers must be better at making change than toll collectors. Sales clerks in department stores need to assist customers as well as take their money. Social skills come into play in almost all jobs. Retail chains train their sales clerks in how to behave toward customers. Police officers need good sense when it comes to people and their behavior. In the professions, education and training shape social skills and attitudes (so that physicians, for example, behave quite differently among themselves than they do in front of nurses or patients).

For skilled work, the universe of possible tasks and procedures (hence the tool kit of skills, the base of knowledge and experience) will be large. The surgeon or cabinetmaker selects from these as needed to do his or her job. Some of the skills are manual, some mental. Lawyers may need good instincts, the ability to think on their feet (like the police officer), coupled with the conceptual skills and fortitude to deal with complex cases that may last for years. A software engineer designing a large program may face thousands of choices in arranging instructions, branches, and subroutines; arriving at the overall shape of the program takes a different set of skills than writing reasonably error-free code on a line-by-line basis.

As such examples suggest, only relatively routine work can be viewed in terms of procedures put together from sequences of well-defined tasks. The greater the need for conceptual and judgmental skills, the less precision the notion of work organization conveys.

By the same token, outputs are harder to evaluate when work depends on higher-order skills such as planning. Standards of quality become subject to debate and disagreement; as discussed in chapter 2, consumers may have little basis for evaluating the services of physicians or lawyers, even after delivery of the service. Evaluation may itself demand judgment and skill (thus creating jobs for people such as music critics). Distinctions between minor league and major league baseball pitchers, chess masters and grand masters, artists (including computer programmers and architects) whose work will last or disappear, may escape observers who are not themselves highly skilled. Instinct, feel, judgment, intuition, inspiration—this is the vocabulary of such distinctions. Measures of productivity may be equally uncertain. Baumol has often noted that string quartets performing for a live audience are no more productive today than a hundred years ago; one might add that people's ability to evaluate and appreciate such performances has probably not improved either.[1]

Measures of skill, then, can rarely be very precise beyond some point of relatively ordinary competence. For such reasons, it is too much to expect expert systems to be able to replicate the procedures of people who truly are experts, though it is not too much to expect computer programs to be ordinarily competent.[2] When learning, people follow rules and instructions for playing a violin or writing software. Those who have become acknowledged experts may sometimes follow clearly visible rules and procedures, sometimes not. Sometimes they break the rules. Higher-order skills involving problem-solving normally come only with time. Extended training, with a good deal of supervised practice, go into making a competent physician or air traffic controller; expertise follows with accumulated experience.

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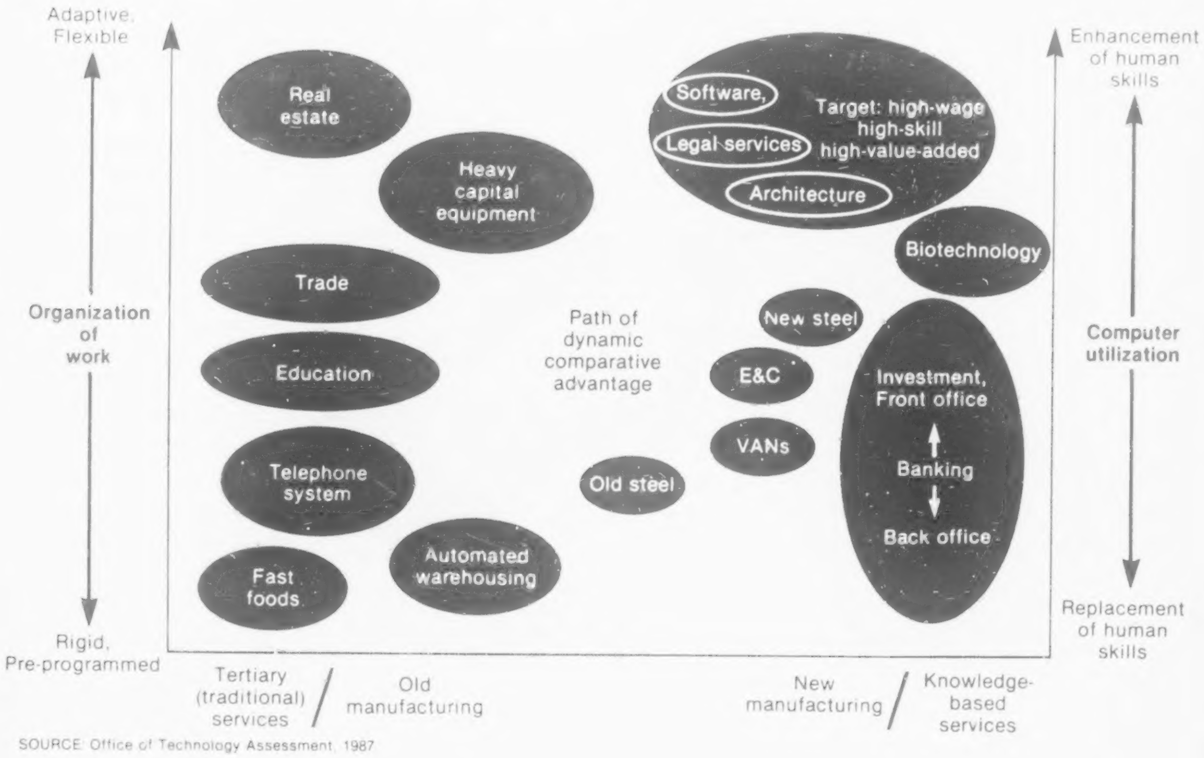
[1] See, for example, W.J. Baumol, "Productivity Policy and the Service Sector," *Managing the Service Economy: Prospects and Problems*, R.P. Inman (ed.) (New York: Cambridge University Press, 1985), p. 301. Beyond the live audience case, broadcasting and recording technologies have of course led to huge productivity advances.

[2] See H. Dreyfus and S. Dreyfus, "Why Computers May Never Think Like People," *Technology Review*, January 1986, p. 43; also H.M. Collins, R.H. Green, and R.C. Draper, "Where's The Expertise?: Expert Systems As a Medium of Knowledge Transfer," *Expert Systems 85*, M. Merry (ed.) (Cambridge, UK: Cambridge University Press, 1985), p. 323.

Finally, it is seldom that isolated tasks set the bounds for work. Many jobs require a good deal of contextual knowledge—an understanding of how the organization and its processes function (table 43). An employee with good contextual knowledge should be able to diagnose problems, help customers, and otherwise get things done because he or she knows where to go and who to talk to; relationships with other people may in fact be the primary defining features of computer-assisted jobs. The associated skills may also be the most difficult to learn: the changing interactions between bank employees and their customers discussed in appendix 8A—and the changing relationships between supervisors and subordinates—illustrate some of the complexities of developing new social and managerial skills.

Figure 49.—Characteristics of Firms and Industries


Adaptive, Flexible
Organization of work
Rigid, Pre-programmed
Real estate
Heavy capital equipment
Trade
Education
Telephone system
Fast foods
Automated warehousing
Software,
Legal services
Architecture
Target: high-wage high-skill high-value-added
Biotechnology
New steel
E&C
VANs
Old steel
Investment, Front office
Banking
Back office
Path of dynamic comparative advantage
Enhancement of human skills
Computer utilization
Replacement of human skills
Tertiary (traditional) services / Old manufacturing
New manufacturing / Knowledge-based services

SOURCE: Office of Technology Assessment, 1987

Table 43.—Patterns of Computer Use by Occupation

Occupations with limited and routine use of computer systems

1. Shopfloor work in manufacturing where computer-based automation is uncommon.
2. Service industry jobs with little or no use of computers (hair stylists, entertainment).
3. Managerial and professional work where people use the system at their own discretion, or for routine functions only (e.g., word processing).

Occupations with extensive computer utilization

Routine:

4. Input-output (data entry, materials handling, loading and unloading of automated production equipment). In general, input-output jobs require little or no interaction with customers, in contrast with data gatekeeper jobs, below.
5. Data gatekeeper—jobs at the boundary between the firm and its customers or suppliers, but requiring little contextual knowledge of the product or production process (e.g., directory assistance operator, order taker for classified advertising).
6. Machine tender (routine monitoring of computer-automated equipment).
7. Troubleshooter (component or equipment level, including routine maintenance and repair, as well as quality control).

Non-routine:

A. Technical and paraprofessional

8. Customer/client/intrafirm service representative—provision of services, outside or inside the firm, requiring greater contextual knowledge than data gatekeeper jobs (e.g., loan officer, travel agent, insurance adjustor, administrative assistant). In jobs with high contextual knowledge requirements, people must understand how the organization works and be able to use that knowledge to get things done.
9. Diagnosis, evaluation, repair, operation, system maintenance (database librarian, paralegal, medical laboratory technician, currency trader).

B. Design, system control, professional

10. Process control, system troubleshooting, crisis intervention (air traffic controller, powerplant operator, financial manager, numerical control machine tool programmer).
11. Product, process, and system design (urban planner, architect, chemical engineer, research scientist).

SOURCE: Adapted from "International Competition in the Service Industries: Impacts of Technological Change and International Trade on U.S. Employment," prepared for OTA by E. Appelbaum, P.S. Albin, R. Koppel, and F. Hormozi under contract No. 533-5560.

systems enhance the skills of employees in adaptive settings. The greater the fraction of a firm's jobs that fall in categories 4-11 of table 43, the farther to the right the firm would be placed in figure 49. A preponderance of jobs in categories 4-7 implies using the computer as a replacement for human skills, hence a position in the lower right portion of the chart. More jobs in categories 8-11 would move the firm upward, closer to the pole marked enhancement of human skills.

Firms with rigid forms of work organization typically employ many people in routine occupations, complemented by a small superstructure of technicians and professionals. Adaptive organizations, on the other hand, generally need people with both broader and deeper skills, and employ relatively large proportions of workers in technical and paraprofessional categories. Rigid work organization correlates with deskilling (except for the technicians and professionals who design the system and keep it running), adaptive with upskilling.

As figure 49 and table 43 suggest, among the occupations most susceptible to technological displacement are routine input-output and data gatekeeper jobs with low contextual knowledge requirements. For instance, self-service, aided by computer systems, has meant declining job opportunities for gasoline station attendants and bank tellers. Other service jobs requiring little contextual knowledge can be exported to low-wage offshore locations (ch. 7). In contrast, high contextual knowledge implies judgmental skills; such jobs are harder to automate, although offering many opportunities for computer enhancement and assistance. Also note that tenure in jobs with low contextual knowledge requirements does little to prepare workers for upward moves within the firm.

INTEGRATED PRODUCTION SYSTEMS: THE NEW MODEL

Figure 49 suggests the outlines of a new model for computer-assisted production, one typified by U.S.-based firms in the upper right of the picture. These new-model firms design, develop, produce, and market knowledge-based services and goods, emphasizing strategic applications of computers and patterns of use that enhance the skills and abilities of at least some of their employees. Many have organized themselves as integrated production systems, with integration implying substantial use of computers and telecommunications to more closely couple product design, production, and marketing and to tie together dispersed geographic locations. In search of flexibility and entrepreneurial behavior, these companies tend to stress employee training and skill development, along with controlled risk taking, delegation of authority, and decentralization. They often approach their markets on a global basis, even when small (e.g., PC software firms).

Some manufacturing firms, as well as knowledge-based service suppliers, fit the new model. In both the services and manufacturing, the new model differs from the old in the social system as well as the technical system, with managers recognizing that it is the interrelationships of computers and people, more than the technical system in isolation, or people's skills and abilities in isolation, that determines the firm's ability to respond to changing circumstance, and, over the longer term, to meet international competition.[14] New social systems generally attempt to increase employee identification with the organization, and commitment to its goals. Sometimes this means real if localized power for employees at lower levels —e.g., a voice in hiring new members of work groups (and perhaps in firing), peer approval for pay raises. Sometimes it means no more than consultation on changes in work organization. In other cases, it has become little more than a sophisticated form of paternalism.

A greater fraction of the employees in new-model firms will need specialized knowledge and training, sometimes job- or occupation-specific, sometimes firm- or industry-specific. Computer graphics, for example, has narrowed some of the differences in skills among people who do cartoon animation, design theater and movie sets, draw maps, or prepare graphic layouts for magazines and books, financial displays, scientific illustrations. Such jobs are found in different industries, and traditionally have been viewed as requiring different skills. With computer automation, they are converging. Likewise, data gatekeeper jobs call on similar kinds of skills across industries—communicating over the telephone, customer service, using data processing systems to access, store, and retrieve information. Note that overlap in job skills among seemingly different occupations and industries eases lateral mobility, one reason for growth in temporary employment (ch. 7). In general, employees of new-model firms will be expected to bring broader (and perhaps deeper) skills to the workplace; the company may use job rotation, work sharing, and small-group production to help develop a multi-skilled labor force. Contextual knowledge will be more important for more people, who will need to know how their work fits into the chain of production, so that they can troubleshoot problems, help customers, make good decisions.

Somewhat more concretely, most companies with organizational structures evolving toward the upper right portion of figure 49 share characteristics from the following list:[15]

- *Firms define jobs somewhat more broadly than in traditional organizations.* Sometimes broader skills and responsibilities follow more or less directly because computer automation permits each person to do more. Sometimes groups take over responsibility for a number of tasks, with individuals learning several jobs and rotating among them. By working in groups, people learn from one another, more easily share skills and information. When people know each others' jobs, or can simply do more, the organization becomes more flexible.

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[14] This corresponds to the classical statement of objectives of the sociotechnical systems approach to job and organizational design—the search for a joint optimum between the technical system (including both process and product technologies) and the social system (that is, the people in the organization, with their skill endowments and foibles, preferences for cooperation or conflict, informal groupings). See, for example, E.L. Trist, et al., *Organizational Choice: Capabilities of Groups at the Coal Face Under Changing Technologies* (London: Tavistock, 1963); E.L. Trist, "The Evolution of Sociotechnical Systems as a Conceptual Framework and as an Action Research Program," *Perspectives on Organization Design and Behavior*, A.H. Van de Ven and W.F. Joyce (eds.) (New York: Wiley, 1981), p. 19.

[15] An earlier version, adapted for manufacturing, appeared in *Technology and Structural Unemployment: Reemploying Displaced Adults*, op. cit., pp. 356-357.

New-model firms, where an employee's actions may have impacts that reach deeper and spread more broadly than in a traditional organization, call for greater contextual knowledge. With many centers of responsibility, and people at relatively low levels making decisions and taking action, employees need to understand how their work affects the rest of the organization. When the same person sells insurance and prepares the policy documents at an on-line terminal, that person must know more and take more responsibility.

When people gain more responsibility and control over their work, they may get more satisfaction from their jobs (some do, some don't).

- As a result of broader job definitions and the need for contextual knowledge, corporations may find they need to give their employees *more and better training*, and may seek *deeper* as well as broader skills (even among employees normally classed as unskilled or semi-skilled).

Firms that have moved to product-centered rather than functional organizations (a distinction discussed at greater length below) usually provide training covering the product line; a few companies have gone beyond, say, marketing information, beginning to discuss profitability or long-range planning with their employees—topics ordinarily reserved for managers.

- Many training programs are intended to expose employees to corporate goals and enhance *motivation, sense of belonging, and commitment* to those goals. Such objectives often merge into the development of contextual knowledge; for instance, a company may devote considerable effort to showing employees how their jobs contribute to the firm's end products. People may be encouraged to view themselves as immediate participants in the production of final services, rather than simply doing a job somewhere along the chain of production. ("I work for MetroBank" rather than "I'm a bank teller.")
- Employees at lower levels may be granted *a say in decisions on equipment and procedures* (e.g., word processing or spreadsheet software), as well as day-to-day operations.

Typically, participation takes the form of meetings between employee representatives and the company's technical and managerial staff. Planners may seek to draw on the experience of the current work force.

Consultative mechanisms, regardless of form, seldom give low-level employees any real control over major decisions—those that shape the system. Only in cases of massive opposition to proposed changes, or where employees are represented by strong labor unions with independent sources of technical expertise, are they likely to be able to influence the fundamental choices that shape the organization of work and the application of technology.

- Managers may give *groups of workers* some or all of the authority formerly vested in first-line supervisors, perhaps including limited control over pace, task design, and work methods, along with responsibility for quality and for coordination with other departments.

When groups take over responsibility for monitoring absenteeism, for allocating work, and for quality control, the supervisor's role may become primarily that of facilitator and communications channel with higher management. As illustrated in appendix 8A, supervisors commonly find themselves spending more time on management, less on administration. Often, the ratio of supervisors to production employees declines; some companies have eliminated first-line supervisors entirely.

Giving supervisory control to work groups can heighten job stress. Among the causes are intra- and inter-group competition—forces that managers look to for greater productivity. Moreover, work groups often have some control over membership—perhaps the power to veto prospective new employees. People who do not fit in may find themselves not only uncomfortable, but out of a job. Work groups carry potential for inequities and abuse that few

American companies have as yet acknowledged.

- In selecting new employees for some kinds of jobs, companies may weigh *motivational and attitudinal factors* more heavily than past experience (or, in some cases, education). Social skills may get new emphasis.

  Some American firms have adopted multiple levels of screening, with aptitude and perhaps psychological tests followed by interviewing. The interviews might involve prospective peers as well as the personnel department and supervisors.
- *Pay scales* may reflect the skills an employee has acquired (e.g., the jobs he or she has mastered—pay for skills) and/or performance (payment for results). In addition to meeting objective standards such as written tests, an employee seeking a pay-for-skills increment may have to be passed by other members of the group, as well as by supervisors.
- In decentralizing, some companies have replaced functional with *product-centered organizations*. The common objective is to channel work smoothly and directly from input to output of the system—creating a faster, more flexible (if not necessarily more efficient) production process.

  The benefits of "channelization" can be quite real, even if hard to quantify. As discussed below, banks have replaced centralized data processing divisions with smaller departments specialized by type of customer (retail stores) or transaction (currency exchange). When a single department provides most or all of the services a given client needs, the bank's employees can respond more quickly, the system becomes more nearly transparent to the client (and to the bank's own employees).

  Product organizations can also contribute to employee motivation and commitment; people may identify more readily with a department that supplies a complete product rather than a piece of one.

While the primary thrust in most new-model firms has been to select and fit people to existing or redesigned jobs, jobs can also be fit to people. This may be a matter of circumventing a lack of literacy or numeracy in the labor pool, designing equipment so that it can be used more easily and more productively (user-friendly computer systems), or finding better ways to call on the capabilities of those who are overeducated for the jobs they find themselves in.

Although no census exists, several thousand U.S. companies appear to share a substantial number of attributes from the list above, with the number in manufacturing probably exceeding that in services.[16] A much larger number of American firms have taken smaller steps, such as the introduction of quality circles. In the services, new model organizations are far more likely to be found in, say, banking, than in construction.

As more organizations consider alternatives such as those outlined above, the questions for U.S. companies and their employees include: Compared with foreign competitors, will American service firms react slowly and uncertainly? Or will they take the initiative? How will decisions taken by corporations, collectively, affect competitiveness? How will skills be affected? Will people be integrated into the system or out of it? Will job ladders and prospects for upward mobility be truncated?

The answers depend mostly on whether American managers in large numbers search out new ways of maximizing the contributions of individual employees to competitive performance—a search that some U.S. firms have embarked on, along with a few European companies and many Japanese organizations (the latter particularly in manufacturing). It seems clear that widespread adoption of at least some features of the new model can help improve the competitiveness of American industries, and thus aid in preserving job opportunities over the longer term. Nonetheless, in the short run, work reorganization in conjunction with computer automation typically causes some kinds of job opportunities to disappear, people to be displaced.

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[16] See R.E. Walton, "From Control to Commitment in the Workplace," *Harvard Business Review*, March-April 1985, p. 76. Also, *Productivity Through Work Innovations: A Work in America Institute Policy Study* (New York: Pergamon, 1982), p. 35.

While a number of the steps outlined above may contribute to making some kinds of work more satisfying, new forms of production systems also bring new dangers, born of the inherent conflicts of interest between firms and their employees. Training programs can end up resembling indoctrination. And what, for example, of people who find themselves at odds with a work group? The more authority managers cede to such groups, the greater the potential for abuse by the group. (Which is not to imply that managers never abuse their power.) Questions of equity would seem to exist already, first and foremost where groups can veto new employees. The modern, bureaucratic corporation, after all, emerged in part from efforts to counter the favoritism, nepotism, and corruption that afflicted earlier forms of organization. In 19th century U.S. factories, Irish gang bosses hired other Irishmen. Groups of Cornish miners working on contract in the Midwest, if not members of the same family, often came from the same village. Work groups today are hardly likely to take such forms, but possibilities for coercion and abuse can plainly arise.

Furthermore, practices such as screening hundreds of applicants before picking a few dozen will strike many Americans as less than fair; a corporation, after all, is not an athletic team. Labor unions, where they exist—and they are relatively rare in U.S. service industries (ch. 7)—can help safeguard the rights of individuals and protect against discrimination in hiring and firing. But some American managers see organizational change as a way to keep out labor unions, and not a few companies view unions as incompatible with new forms of work organization.

IMPACTS ON COMPETITIVE ABILITY

As noted earlier, American managers have often been criticized for placing higher priorities on immediate cost savings and short-term profits than on investments leading to indirect and/or strategic payoffs visible only over the longer run. As this section will show, many of the most significant impacts of new-model production systems come about indirectly. For instance, greater job satisfaction can help reduce employee turnover, hence costs for training new employees (including lost production during on-the-job learning). Thus the speed with which American companies move toward new-model organizational forms may provide one test of the proposition that incentives in the U.S. economy skew managerial decisions toward the short term.

Citibank's shift in its back offices from a functional to a channelized or product organization illustrates some of the indirect impacts, here through improved customer service.[17] During the 1960s and into the 1970s, Citibank, like most financial services firms, fed all its transactions through a large centralized data processing division—the functional approach common in an era of batch processing on expensive mainframe computers. In Citi's DP division, all transactions (e.g., checks) passed in sequence through half a dozen departments organized by function (e.g., coding and keypunching—the system roughly paralleled that described in box Z for batch processing of insurance claims). Different transactions—checks, letters of credit, foreign exchange—took different routes through the DP division, but all were handled in basically the same way. There were no distinctions between, say, corporate and individual accounts. Each time the paperwork for a transaction crossed the boundaries between departments, it moved from the province of one manager to another. With responsibility fragmented, errors were easy to make and hard to trace.

The company redesigned and decentralized its transaction processing system so that a single manager would have end-to-end responsi-

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[17] R.W. Walters, "The Citibank Project: Improving Productivity Through Work Redesign," *The Innovative Organization: Productivity Programs in Action*, R. Zager and M.P. Rosow (eds.) (New York: Pergamon, 1982), p. 109.

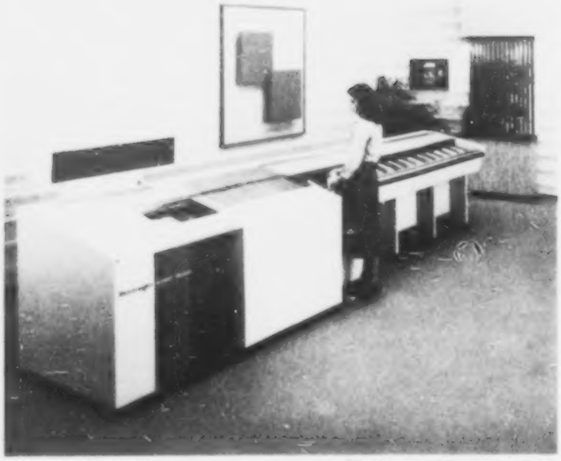

Photo credit: Burroughs Corp.

Automated reader/sorter for processing checks

bility for a single type of transaction (product). Different departments now handle letters of credit, depending on the customer (government, correspondent banks, Citicorp branches) as well as the geographic market. Each transaction follows a well-defined path or channel from the time it enters the Citibank system until it leaves, with management responsibility clearly defined at each point.

Just as in the insurance industry, cheap computing power, specialized work stations, and friendlier software make product forms of organization practical in banking. Of course, assigning different departments full responsibility for the needs of different groups of customers inevitably means duplication of equipment. Capital costs may rise. But today, in many banks, checks stay within one department, lines of responsibility are shorter, and, in principle, service is faster and more responsive. A customer with a question should get a quick answer. Even if the company's cost structure does not show improvement, better service should be good for business and for competitiveness.

Given such examples, it should be no surprise that little concrete data exists for evaluating work reorganization and computer integration in new-model organizations. Certainly, most companies, when they introduce new forms of production systems, do so to improve efficiency, defined broadly. But they seldom reveal quantitative information on the success of these efforts. Indeed, it can be hard for the company itself to tell whether new forms of work organization have been successful, if only because conventional accounting measures may fail to capture the full range of benefits. After all, what *is* the dollar value of better customer service or greater flexibility? How can projections into the future capture strategic advantages?

Some generalizations, nonetheless, hold quite broadly. New-model organizations normally have somewhat higher fixed costs compared with old-model systems. Even in the absence of heavy investments in computers, peripherals, and software, capital costs typically go up for the simple reason that many job redesigns entail redundant equipment for parallel product departments or work groups. New buildings will cost more to the extent that they provide more space or need coaxial cabling and light guides for computer networks and telecommunications links. As table 44 indicates, direct labor costs may go up or down, with substantial indirect cost savings possible. Training costs per employee increase when jobs become broader or more complex, although net expenditures on training may drop if turnover declines. Reducing or eliminating first-line supervisors cuts labor costs directly. Shorter, more direct interpersonal communication channels can also save money.

But costs give only part of the picture. When MetroBank (app. 8A) reorganized, it accepted relatively high costs as part of its new strategy. Purchasers who get more responsive service may order more; new customers may be attracted by word of mouth. The point is a general one: work reorganization can help companies initiate and pursue new business strategies. There is every reason to believe that, over the longer term, new-model firms in U.S. service industries (and in manufacturing) will be able to gain advantages in both domestic and international competition.

Table 44.—Typical Changes in Cost Structure for New-Model Organizations

	Direction of cost shift
Capital costs:	
Buildings and equipment	Up (smart buildings, more computers)
Transient costs associated with work reorganization:	
Startup	May go up or down. Broadening of jobs and skills tends to increase startup costs
Lost time for meetings and consultations with employees during the design phase	Up
Consulting and contract services	Up, if used
Direct operating costs:	
Direct labor content per unit of output	May go up or down
Pay scales	Up or down. Pay-for-skills, bonus, and gain-sharing tend to raise wage levels, but many of the companies in the United States adopting such plans will probably remain non-union.
Quality control, inspection and error-correction costs	Down
Indirect operating costs:	
Downtime (unplanned idle time)	Down, especially where more flexible systems replace old-model organizational forms such as assembly lines, with their potential for shutdowns caused by minor problems.
Lost production during meetings	Up
Training costs per worker	Up
Heating, lighting, other utilities and services	Up or down. Employee suggestions may lead to savings.
Maintenance costs	Generally up. (More equipment means more maintenance, although computer and telecommunications equipment is growing steadily more reliable.)
Indirect labor and supervisory costs per unit of output	Down
Cost categories with both direct and indirect components; intangible costs:	
Cost penalties and avoidable mistakes resulting from insufficient employee involvement in the initial design of the production system	Down
Costs associated with employee absenteeism and turnover (including recruitment expenses, training, overtime, wages for relief and utility workers)	Down
Added costs associated with operating at part-capacity	Down
Communication costs within the organization	Up or down
Wastage, including theft	Down
Grievances	Down
Costs associated with minor changes in product design	Down, unless new equipment needed
Customer dissatisfaction	Down
Other costs attributable to employee dissatisfaction or low morale	Down

SOURCE: Office of Technology Assessment, 1987.

CONCLUDING REMARKS

Applications of technology matter for competitiveness in services: they exert direct and indirect impacts on costs; lead to new strategic opportunities; help ensure consistent and high-quality output; keep customers satisfied; enhance the firm's reputation. Most of the early uses of computer and communications systems focused on cost cutting. Today, strategic considerations—seeking to establish new products, push into new markets, provide better service to customers—have overtaken cost control as a managerial priority. Reorganized and more flexible production systems have become intrinsic elements in the strategies of a growing number of American service firms. Japanese companies have turned effective work organization into a potent source of competitive advantage in manufacturing; they could eventually do so in the services. American service firms cannot afford to fall behind.

Given the unstable operating environments that now characterize so many international industries, greater flexibility—in part through a labor force with broader and deeper skills (and in part from greater use of temporary and part-time employees)—can enhance competitiveness. So can technology that helps people use their skills effectively. New possibilities for the applications of technology often appear faster than people can apply them. Managers have been confused, unsure of how to invest their firm's resources. Lower level employees have been confused, unsure whether or not to welcome the terminal that appears on their desk one morning. Economists have looked at the statistics and concluded that much of the money has been wasted, that new technologies have been deployed unwisely because productivity growth in the services remains low; they are confused because their measures fail to capture changes in output characteristics.

This avalanche of technology opens new avenues for designing production systems that match the needs of the people using them—and the needs of customers. By adopting system design criteria that judge technology in terms of its contributions to the system as a whole, companies can—in principle—achieve combinations of flexibility and efficiency unheard of when computers were expensive. Good solutions to the problems of computer utilization in new-model production systems can cut costs and improve productivity while also yielding strategic advantages.

New-model production systems will be simultaneously more integrated and more flexible. What does this imply? On a macro level, greater use of computer networks to link dispersed operating units, and greater commonality in equipment and in databases—the goal being to tie product development and marketing more closely to the production process. On a micro level, it implies decentralized and semi-autonomous forms of work organization—product departments, end-to-end production channels, employees with broader and deeper skills, job rotation.

In theory—practical implementation is another matter, as the appendix to this chapter shows—a more integrated system should (perhaps somewhat paradoxically) be able to adapt more readily to new product designs, to shifts in mix or volume, even to changes in government policies. To do so, the system must effectively integrate people and machines, which, in turn, means that employees at all levels will need new skills—reasoning, problem-solving, acting autonomously.

Micro level integration becomes easier with smaller, cheaper, more friendly computer systems. For instance, fourth-generation languages mean that end-users with relatively little training can create their own applications programs. Indeed, fourth-generation software, making possible fluid and evolving system designs, may permit firms to move toward organizational structures, as well as particular applications, that can evolve over time to meet the needs and desires of individual employees.

In general, effective integration implies giving employees at all levels greater responsibility. This may mean giving them a stake in the success of the enterprise—and in the security of their own jobs—through gain-sharing, bonus, or profit-sharing plans. Even among the most tradition-bound American managers, many have begun to acknowledge the need for greater employee involvement as companies move into high technology and face new competitive pressures.

Given better computer and communications systems, and a better educated, better trained, and more responsible work force, companies should be able to maintain effective internal coordination and control, even as management styles loosen. Why? Because managers seek tight control in part as a hedge against partial or faulty information. With an integrated production system, enlightened corporations may loosen the reins, upper managers lose some of their fear that the system will go out of control.

Meanwhile, less enlightened companies may move in the opposite direction, towards more rigid forms of work organization. Some will seek to use more and better information to tighten supervision, losing the benefits of flexibility. Of course, productivity in some industries will continue to depend on close control over task assignments, and on rigid forms of work organization: there is little need for flexibility (outside well-defined bounds) in most fast-food outlets, or in a telephone company. And, although managers may seek to reduce costs associated with employee absenteeism, turnover, even sabotage, they do not develop new production systems just to keep people happy. Particularly in the tertiary services, tensions between productivity and quality of working life may change little if at all; managers will push for efficiency, employees for less stress, a more tolerable environment. Productivity will continue to come at the expense of job satisfaction and quality of working life, if only because some kinds of production—in the services and in manufacturing—will continue to demand routine and repetitive work; flexibility is not always needed.

More broadly, however, continued development of new-model organizations seems likely to slowly extend the bounds of employee control. The reasons are largely technological, inherent in the design and operation of complex systems. Distributed computing will be a primary tool for automation and integration. Highly automated systems may need fewer employees, but these employees will bear heavier responsibilities. Automated systems cannot be idiot-proofed; indeed they tend to be more sensitive, less robust than labor-intensive systems.[18] One person's mistake can shut down a highly integrated system, where in a more labor-intensive organization the consequences would remain localized. If integrated systems are to function effectively, employees must have considerable freedom of action, and the knowledge and skills to intervene swiftly and appropriately. In consequence, some of the distinctions between managers and other employees will narrow. As ordinary employees take on greater responsibilities, companies will find it in their interests to treat and train them more like supervisors and professionals. A high-skill economy will depend on a labor force that can accept authority, use good judgment.

The technology of integrated production systems, then, will break down some of the barriers in hierarchical organizations. In many cases, the barriers will come down fastest and farthest within management. Natural enemies —marketing departments and back offices, managers on the same level in the hierarchy—will have to work together, much as production and quality control must be integrated in new-model manufacturing plants. Particularly at middle levels, managers will lose power (and some will lose their jobs). None of this will happen without a struggle. American industry carries a heavy burden: hundreds of thousands of managers who learned the ways of the 1950s and 1960s, many if not most of whom will never feel at home in a new-model system.

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[18] The reasons begin but hardly end with the elusiveness of software errors. In general, control models themselves can only represent a portion of the system, so that people must bridge the resulting islands of automation. Furthermore, control models tend to break down because of contingencies that were overlooked or simply cannot be incorporated into the model. By definition, when the model breaks down the system is out of control and people must take over. Technical constraints inherent in control models mean that development of large-scale computer-integrated systems will continue to be slow and painful, with progress depending on trial-and-error and incremental improvement.

In the end, it will be more difficult to trace power and authority to particular people except at the upper executive levels. The implication: evolving organizations will need new mechanisms for resolving conflicts among managers with different goals and priorities (one of the things Japanese companies are good at), as well as for resolving conflicts between labor and management. Where these mechanisms do not develop, competitiveness will suffer. Likewise, where companies rely too heavily on computers, particularly in routine applications, they may find their work force slowly losing the core of experience-based learning that will always be needed. A further implication: group responsibility will have to replace individual responsibility, managers will have to begin thinking of themselves as members of multi-skilled work teams.

What does this mean for Americans in the labor force, or ready to enter it? In some cases, it will mean greater stratification within service-oriented companies. Some highly skilled (and highly motivated) employees will have relatively secure jobs, with good pay and prospects for rapid advancement. Others will have full-time jobs but limited upward mobility. A third group may find themselves limited to part-time and temporary work, serving as buffers against uncertainty and market fluctuations. Credentials will become more important for securing the kinds of entry-level positions that lead to on-the-job learning and skill development. More career ladders will begin with post-high school education—2-year and community colleges, vocation-technical schools, bachelor's level programs. High-school graduates—and those who have not graduated—will have a more difficult time proving to employers that they deserve a chance to learn and move upward. On-the-job learning in the new services may be just as important as in the older manufacturing industries, but the preponderance of mental and social skills over manual skills will lead employers to place more emphasis on educational credentials for entry.

Greater flexibility and improved competitiveness will prove a two-edged sword in another way: some service industries may be able to increase their competitiveness only at the expense of jobs and job opportunities. In others, output may grow sufficiently to keep everyone at work, or to create new jobs. But companies that can respond quickly and effectively to shifts in exchange rates and world market conditions, the uncertainties of consumer demand, and changes in technology itself, will always be well-placed to prosper in international competition. To strengthen its long-term competitive capacity, the United States will have to strengthen its institutional mechanisms for continuing education and training (ch. 10).

Most of this chapter has focused on industries that have invested heavily in computers and communications, doing so in rather speculative fashion. But jobs in the traditional, tertiary services—including those least likely to be automated—will continue to depend in various ways on the knowledge-based sectors; a nation that grows more competitive in high-value-added industries will, all else equal, have higher living standards and more jobs for everyone. Because of this, one of the most effective, if indirect, roles for government comes through the complex of policies that support and encourage the development of human capital. This implies not only education and training—traditional responsibilities of Federal, State, and local governments—but aid for the adjustments and transitions involved when people and companies find themselves moving into new and different forms of work organization. The rationale is straightforward: by helping ease and guide the transition to a knowledge-based economy, public policies can contribute to maintaining U.S. employment, to the international competitiveness of U.S. firms, and to the Nation's standard of living.

APPENDIX 8A: RESTRUCTURING AND WORK REORGANIZATION AT METROBANK[19]

In the late 1970s, MetroBank—a medium-sized competitor in a large urban/suburban market—entered a crisis from which it is still recovering. Burdened with bad international loans, and locked into long-term deposit certificates at a time of rising interest rates, the company faced a cash flow squeeze; it was saved only when a consortium of other banks lent it capital. When the consortium partners insisted that MetroBank restructure its operations, the president and executive team were replaced, many middle managers were fired, branches, subsidiaries and real estate holdings were sold, and liabilities (including the deposit base) were cut in half. A new strategy and new structure meant new job responsibilities for nearly all the bank's employees.

New Products, Changing Jobs

Two years into its reorganization, MetroBank faced the question of formulating a strategy suited to its altered circumstances. Recent history showed it could no longer be a national player, while suggesting a focus on the regional market. Although many commercial clients had withdrawn their accounts when the bank was threatened, the retail base remained loyal. Household customers identified with MetroBank, a local mainstay for decades. To build on this base in a period of deregulation—with ongoing competitive threats from other financial service firms, including entrants from outside the banking industry—MetroBank sought to broaden its range of products and to stress personalized service. This high-value-added niche strategy encompassed three main elements:

1. development of 14 new banking products (e.g., credit cards, Keogh and individual retirement accounts, money market accounts, money-saver checking accounts, car leasing), thus offering consumers a portfolio of services;
2. an active selling program at the branch level intended to increase the number of accounts and products per household; and
3. decentralization of responsibility for commercial lending to smaller businesses from the main office to the branches.

Together, these three steps were meant to stabilize the deposit base by increasing customer reliance on the bank, and to focus lending within MetroBank's market. Senior managers hoped to develop "relationship" banking at the branch level by strengthening ties with neighborhood businesses. At this time, MetroBank operated about a hundred branches, and employed 2,000 people.

With the new strategy in place, MetroBank's employees describe their jobs differently. Branch personnel, including managers, refer to a shift from *operations* to *sales*, from *administration* to *planning*, from *order taking* to *selling*. As one branch manager put it, "Before . . . all you had to do was to see if there were enough supplies, if procedures were followed, and get the paperwork done. You wanted to get people in and out the door. Now . . . we're in the retail business."

Employee roles changed, particularly for customer service representatives, branch managers, and area managers:

- *Customer Service Representatives*. Prior to the crisis, the CSRs (or platform workers, as many employees call them) helped customers balance their check books and open new accounts. They were a cut above secretaries. But MetroBank's senior managers believed that the CSRs had to become the backbone of the selling effort in each branch. They were to "cross-sell" products—to convince customers coming in for help to buy other products and services. MetroBank's management created a budget for retraining the platform workers, and instituted a measurement system to assess their sales performance.
- *Branch Managers*. In the past, branch managers were primarily administrators, evaluated largely on their ability to control costs. Since the restructuring, they have been asked to generate loans, particularly among businesses with revenues of less than $10 million. Many of the branch managers, lacking prior lending experience, have enrolled in the bank's ongoing credit and lending courses. In addition, branch managers must coach and supervise sales efforts by the platform workers.
- *Area Managers*. This is a new position, the least defined of the three. Each area manager oversees a group of branches, helping with planning, marketing, and budgeting.

As this summary suggests, MetroBank's restructuring will, if successful, upgrade the jobs and skills of many employees in its 100-some branches. CSRs will sell rather than simply respond to inquiries, branch managers develop loans on the outside as well as administer operations on the inside. Employees will have to cope with greater levels of uncertainty as the bank tries to actively shape its markets, rather than taking them as givens.

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[19] This appendix is based on a case study prepared for OTA by L. Hirschhorn, Wharton Center for Applied Research, under contract No. 533-5970. The name of the bank and some details have been changed.

The Transition

Developing new skills and managing the shifting relationships between main office and branches has meant a series of adjustments, many of them less than smooth.

New Skills

The transition has been a difficult one for the hundreds of platform workers expected to do the bulk of the selling and cross-selling of new products that range from credit cards to second mortgages for financing a child's education. MetroBank purchased two off-the-shelf training courses from a vendor; all CSRs took the course dealing with selling skills, plus a shortened version of a course on financial counseling. The courses proved no more than marginally effective

The platform workers face three sets of difficulties: taking authority; managing uncertainty; and planning their time. Two studies by consulting firms indicated that CSRs feel out of place selling the bank's products and services. A shopper's study (in which pseudo-customers came in with unstructured requests) found that platform workers could explain bank products effectively, but frequently failed to close the sale. Interviews with the platform workers showed that most still see their work as customer service—e.g., explaining bank statements—not sales. Almost all complained that they did not have time to cross-sell; moreover, they tended to see management pressure for greater selling effort as simply asking for more work. Striking disparities characterize the language of senior managers, who speak of culture change, and the words of CSRs, describing what to them seems a "speed-up." Earlier, most of the platform workers (and other line employees) functioned primarily like clerks and secretaries. While their resistance reflects some of the classic tensions between managers and workers, it also reflects the difficulty of instituting major changes in the everyday responsibility of a relatively large group of employees.

Eventually, the question of career prospects and ambitions may prove central. MetroBank has cut its costs in part by using more part-time tellers and a "tight" platform in many branches. The company has continued to view its line workers as expenses rather than assets, while at the same time wanting them to take on more responsibility. Interviews show that few CSRs identify with the bank as a whole. Many like to work close to home. They are not only reluctant to take on authority and to sell, they don't want a career that would take them to other branches. One said, "If I wanted to go up, I would have been out of this branch a long time ago. . . . All I want is my 10 years and to vest my pension." Interviews also indicate that many CSRs still think of themselves in secretarial terms, raising the question of whether MetroBank is recruiting the right kinds of people. The desire to control costs leads to hiring of platform workers in the labor market for secretaries and clericals. Yet the image held by managers suggests someone who wants authority and opportunities to rise in the bank.

Technology

Some staff and managers at MetroBank believe that improvements to the computer network used by the platform workers will help. The redesign of the system will proceed in three stages. At first, CSRs will be able to call up information but not enter data. In the second stage, they will be able to change files on-line. Eventually, they will be able to produce final documents ready for customer signature. Experience at other banks suggests that this will help give employees a new perspective on their jobs. Platform workers will have full and complete data on the customer and on all the bank's products. They will no longer need to call the main office for information. In addition, they will be able to walk customers through various "what-if" demonstrations (e.g., the pay-out on an IRA) as a selling aid. Eventually, their terminals will be able to display taped presentations on the bank's products. As the terminal becomes an information utility, the platform workers may come to accept that they are in positions of real responsibility and authority.

Thus far, redesign of the computer network has not gone smoothly. Branch and division managers have had trouble working with the systems division. Systems engineers have shown little knowledge of, and little interest in, the development of user-friendly software—nor have they made any effort to learn from the platform workers, or get feedback from them. Most strikingly, the systems division has failed to provide training, despite repeated requests and protests from MetroBank's line managers.

Managing Uncertainty and Planning Time

Previously, the CSRs simply helped customers as they entered the branch. Platform workers did not have to plan who they would see, when and why, for how long. Now, they have been asked to develop a sense of priorities — to gage the value of time spent with each customer, and the value of time spent on service as opposed to sales. As one branch manager put it, "In an 8-hour day, you can't wait on one customer for an hour. I tell my people to develop each customer to the maximum. They should also try to get their operations work done outside of contact hours." Some platform workers complain that they have too much paperwork, and cannot do the telephone selling expected of them after the branch closes in the afternoon.

The CSRs must also learn to live with uncertainty. The outcome of a sales encounter may not be apparent for weeks; success can only be measured by averages. Psychologically, this means that the platform workers must learn to live with failures by betting on future successes. Earlier, the platform workers could get a sense of accomplishment simply through helping customers as they entered the branch.

Relationships Between Branches and the Main Office

This aspect of the transition has two dimensions: working relationships between superiors and subordinates (which changed with the decentralization of lending responsibility); and relationships between line and staff. Before restructuring, branches were viewed as little more than mail drops for the main office's lending business. MetroBank's new strategy calls for branch managers to spend half their time calling on potential loan customers. To help them develop lending and selling skills, the branch managers were given credit and salesmanship courses. Senior executives also wanted to shift their managers' attention from expenses to profits, from absolute deposit levels to market share. As one area manager said "I tell my branch managers, 'You are a profit center.' We are not telling them, 'You must ring 200 door bells . . .' we are saying, 'tell us what you did, what you achieved.' "

Thus the rules have changed just as much for lower level managers as for the platform workers they supervise. One branch manager said, ". . . in commercial lending, you walk out the door not knowing if you have accomplished anything." At the same time, branch managers must now coach their own subordinates, rather than simply monitoring their performance. Formerly, the CSRs and other branch employees had little discretion; they simply followed standard procedures. Now, the supervisors face a more difficult job: helping CSRs learn to sell, and to use the new computer system. Interviews indicate that few branch managers, as yet, have mastered the coaching process. Indeed, one noted that *he* needed supervision from his area manager: "We need someone to take a look at individual management styles, how you're doing compared to the norms. Not necessarily someone to look over your shoulder, but someone to go out on a sales call, and sit in on a staff meeting."

Planning is also new for the branch managers. MetroBank's marketing department regularly asks each manager to assess his branch's performance, evaluate its strengths and weaknesses, and prepare a business plan. The head of the market planning unit has expressed considerable disappointment with this exercise, reporting that the branch managers were not very self-critical, argued that they had no real control, and were insensitive to market share as a measure of success. The marketing department has since taken over preparation of business plans for the branches.

The Area Managers

The most striking characteristic of an area manager's job is its poor definition. In principle, area managers are in charge of marketing for a group of 5 to 10 branches. Yet they have no marketing budgets. One said, "I need permission to spend $2,000 for a party at a senior citizens home." Nor do area managers systematically review the performance of branches.

The poorly defined role of area managers may suggest that MetroBank has focused too heavily on the lower levels, placing most of the burden of change on those in the branches. Upper management may be "leading from behind," reluctant to cede real power to those lower in the hierarchy even though this is necessary for decentralization to work. Whenever top managers delegate authority, they face loss of control. MetroBank's senior executives may have felt more comfortable delegating to those at the bottom—whose authority will in any case be limited to a single branch—rather than to the area managers.

Such possibilities highlight what MetroBank executives call the problem of "creating a new culture." Those at all levels speak of the old culture as a bureaucratic one. They know that success in the future depends on becoming less bureaucratic, which means authorizing people to act with more independence. But the older culture, and its norms, persists. While wanting the platform workers to take more initiative, some managers think they're lazy. Meanwhile, ample evidence exists that platform workers lack the support (e.g., coaching, computer training) needed to be effective in their new roles.

Customers

In many high-value-added industries, products are tailored to fit the client's needs; the customer has an intrinsic role in the production process, in effect co-producing the service. This leads MetroBank's senior managers to speak of relationship banking, while for the platform workers it means educating the customer. In interviews, many CSRs reflected on customer confusion over the features and benefits of IRAs and other new products: ". . . a lot of people don't know anything about money market accounts . . . people are afraid to use overdraft protection . . . customers can't see that if they pay off on their credit cards in time there is no finance charge."

In fact, marketing experiments suggest that many of MetroBank's customers are quite conservative. Few have responded to offers such as free checking and free travelers checks as part of packages including other products. Some of MetroBank's product development efforts have failed for reasons that executives attribute to customer confusion. Regardless of the reasons for such failures, they highlight the need for firms in high-value-added industries to develop a good grasp of customer desires and motivations. In pursuing its high-value-added strategy, MetroBank has become dependent on how its consumers see the world, on what they want.

Summary

For MetroBank's strategy to succeed, its employees, including managers, will need new skills and attitudes. At the most general level, this means learning to live with uncertainty. For the bank as a whole, the marketplace is less predictable because of deregulation. For individual employees, uncertainty (and anxiety) comes with the need to sell new retail products and bring in loan business. By giving the platform workers more immediate access to information, and by increasing their apparent competence in the eyes of customers, the redesigned computer system may help resolve some of the tensions. But several years after restructuring, MetroBank cannot yet feel confident in its new strategy.

Chapter 9

Foreign Government Policies

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Chapter 9

Foreign Government Policies

SUMMARY

Since the November 1982 Ministerial Meeting of the General Agreement on Tariffs and Trade (GATT), the United States has pressed for multilateral negotiations aimed at liberalizing services trade. As discussions continued, the prospective agenda broadened: services became the centerpiece of a group of "new issues" including foreign investment, trade in high-technology goods, intellectual property protection and anti-counterfeiting measures, and restrictions on transborder data flows. For a time, the U.S. proposals led some people to refer to the planned talks as a services round. Eventually the scope expanded still further, as the United States and other countries sought discussions on issues well-removed from services —e.g., agricultural trade. The preparatory process initiated at the 1982 Ministerial culminated 4 years later in agreement to begin the Uruguay Round, during which GATT members will discuss services for the first time. The 4-year schedule for the new round is an ambitious one; given the pace in such organizations, and the difficulties to be expected, inclusion of services within GATT codes before the middle to late 1990s would be surprising.[1]

This chapter outlines government policies in major trading nations and developing countries in the context of the Uruguay Round. The focus is on policies toward the services as a group, to the extent that such policies exist. In fact, few governments have had active policies toward the services sides of their economies. Preparations for the new round were dogged by controversy in part because few governments grasped what was at stake, and what they might have to gain. Resistance came at first from other industrialized countries, as well as the more industrialized developing countries—notably Brazil and India.

By the middle of 1986, the rest of the industrialized world had lined up behind the U.S. position—which itself had shifted to de-emphasize services somewhat. But opposition by a group of about 10 developing countries remained firm, and has become, in effect, the beginning of their negotiating strategy. Opposition—which extends not only to services, but to the new issues generally—has been rooted in part in the economic development strategies pursued by these countries. Baldly stated, parts of the developing world also believe that anything the United States wants is likely to be bad for them. This chapter seeks to explain the opposition, while also reviewing policies in other countries that affect trade and competition in the services; among other purposes, such a review may suggest lessons for the United States —both policy approaches the Federal Government might emulate, and those it should avoid.

Several of the other new issues straddle the boundary between goods and services; the chapter treats them mostly as they relate to services trade. Investment restrictions, for example, have particular relevance because a foreign presence is needed for producing so many service products; the Uruguay Round participants will take up trade-related investment—meaning, most directly, performance requirements that set conditions (such as exporting some production) for direct investment. When it comes to trade in high technology, most of the questions revolve around subsidies and other aspects of national industrial policies. These touch particularly on the complex of services associated with information processing, as do transborder data flow (TBDF) restrictions—which could also affect services like banking that depend heavily on international telecommunications. Intellectual property protection is particularly important for software and information services.

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[1] On the GATT, see *U.S. Industrial Competitiveness: A Comparison of Steel, Electronics, and Automobiles* (Washington, DC: Office of Technology Assessment, July 1981), pp. 185-186. On the preceding Tokyo Round, U.S. trade law as it relates to merchandise, and U.S. trade policy in general, see *International Competitiveness in Electronics* (Washington, DC: Office of Technology Assessment, November 1983), ch. 11, especially pp. 430-438. For a discussion of national and international regulations covering trade in services, see R.K. Shelp, *Beyond Industrialization: Ascendancy of the Global Service Economy* (New York: Praeger, 1981), chs. 5-7.

The Uruguay Round promises to be the most complex since the founding of GATT in 1947. The reasons begin with the loss of U.S. economic hegemony, which makes these talks more nearly a negotiation among equals than at any time in the past. Reaching agreements on services will be especially difficult because many service industries have traditionally been regulated by governments for domestic reasons (protection of consumers and investors in the case of banking and insurance) or operated as public monopolies (telecommunications). For governments wishing to protect their service industries, regulatory policies have provided convenient barriers to trade and investment. And lacking clean distinctions between trade policies and domestic policies, governments will, quite naturally, resist what they regard as interference in their domestic affairs.

GOVERNMENT POLICIES TOWARD THE SERVICES

Trade Policies and Domestic Policies

Table 45 distinguishes broadly between trade policies and policies that are primarily domestic but have implications for trade. The middle ground includes government organization, collection and analysis of statistical data, and taxation. (App. 10A, at the end of the next chapter, gives examples of the ways U.S. tax policy can affect competitiveness.) Many policies, regardless of category, affect competitiveness indirectly—i.e., by conditioning corporate decisions. The range of these indirect impacts extends to expectations of future policies; if managers think Congress may pass a tax bill this year, that expectation will influence their capital investment choices. Some of the policies listed in table 45—e.g., foreign investment controls—have been unimportant in the United States, though familiar tools elsewhere.

Of course domestic policies affect trade, while trade policies serve domestic purposes. The United States deregulated its telecommunications industry for domestic reasons, but this shift in policy has had widespread international ramifications. At the same time, governments may design regulatory policies to act as nontariff barriers (NTBs), particularly in industries like banking and insurance where it is easy to tilt the rules to give domestic firms an advantage. Table 45 simply imposes a nominal ordering on policies with possible impacts on trade and competition in the services.

Barriers to Trade and Investment

Any policy that discriminates against foreign suppliers except a simple tax on incoming goods or services constitutes a non-tariff barrier. When the French required all imported video-

Table 45.—Policies Affecting the Services

Primarily trade-related	Both trade and domestic imports	Nominally domestic but with impacts on trade
Nontariff trade barriers (NTBs) Foreign investment controls Export credits and subsidies (e.g., tied development aid) Export promotion Export restrictions	Taxation (differential rates across sectors, R&D tax credits, etc.) Data collection and analysis Government organization	Technology policy (including R&D supports and subsidies, and technical standards) Investment grants and subsidies Procurement Labor market and human resources policies Domestic regulation (including antitrust and competition policy) Intellectual property protection

SOURCE: Office of Technology Assessment, 1987 cassette recorders to enter through Poitiers, where they overwhelmed the small port-of-entry staff and backed up by the truck-load, France was imposing an NTB. An equally well-publicized example: Japan's use of product standards to keep out American-made baseball bats. Foreigners have said that U.S. product liability laws amount to NTBs. Some Americans make the same claim for Japan's vast and fragmented retail distribution system; the country has many more—but smaller—retail outlets per capita than Europe or the United States, with more layers of distribution to supply them.[2] Other NTBs include formal and informal quotas, implicit and explicit subsidies for domestic producers, and discriminatory government procurement practices (buy national requirements).

Given the nature of production in the services, most trade barriers will be non-tariff in nature (ch. 2). (The exceptions consist of service products with at least some of the characteristics of goods—e.g., computer software—so that shipments can be monitored at borders and duties assessed.) NTBs pose knotty problems for negotiators. Quotas and direct subsidies are visible, but other policies may be NTBs only in the eye of the beholder. Moreover, when it comes to implicit subsidies, or regulatory policies that treat, say, foreign banks differently from domestic banks, the impacts on trade may be uncertain. This makes it more difficult for governments to negotiate matching concessions. Trading tariff cuts on wheat for those on computer chips may be straightforward compared with reaching agreements on banking regulations that treat domestic and foreign firms in ways agreed to be fair.

No matter how an NTB functions, the usual result is the same as for a tariff—restricted supply, higher prices. Of course, that is the purpose: governments impose import quotas to raise price levels, increasing the revenues of domestic producers. The U.S. Government has, at various times, restricted imports of steel so that American steelmakers could raise their prices, supposedly generating profits to be put toward modernization and renewed competitiveness. Subsidies or procurement preferences for domestic suppliers have the same objective: financial support through greater cash flow or higher profits.

Keeping in mind that many NTBs in the services have possible rationales in terms of domestic regulations, they can be classified into three types:[3]

1. purely protectionist NTBs, more or less openly designed to shelter domestic companies from foreign competition;
2. quasi-NTBs, most commonly regulations with some justification in terms of domestic policies but which may also have been tailored to protect a domestic industry;
3. accidental NTBs, instituted for bona fide domestic purposes but restricting, perhaps inadvertently, trade or investment.

If pure NTBs are transparent and clearly protectionist, quasi-NTBs come with a built-in excuse—while accidental NTBs, in effect, are honest quasi-NTBs with protective side-effects. The maze of banking regulations in the United States, for example—many under the control of the States—includes some provisions that give U.S. banks advantages over foreign-owned institutions and other provisions that place U.S. banks at a disadvantage. And if a domestic industry is regulated for bona fide reasons, while foreign firms might be able to evade these regulations, then pre-conditions on entry may be quite legitimate, serving to equalize competition and avoid disruption of the industry. Insurance provides a typical case. Governments normally require insurance companies to maintain reserves of capital sufficient to cover possible claims. If the host country insists that capital reserves be held inside its borders, and if the reserve requirements are high, foreign carriers may decline to enter the market. Such a policy effectively insulates domestic firms. In some countries, capital requirements imposed on insurance firms fall into the quasi-NTB category, while in others they are closer to accidental NTBs.[4] A later section of the chapter discusses regulatory NTBs in banking and telecommunications in more detail.

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[2] The typical 7-Eleven store in Japan is half the size of one in the United States—S. Chira, "Convenience Stores Are Thriving in Japan," *New York Times*, Dec. 24, 1984, p. 33. While 7-Eleven, like many Western companies, has learned to accommodate itself to the Japanese market, others have been unable to find their way through the maze of distribution channels.

[3] I. Walter, "Non-Tariff Barriers and the Free-Trade Option," *Banca Nazionale del Lavoro Quarterly Review*, No. 88, March 1969, p. 20.

GATT AND THE U.S. SERVICES INITIATIVE

The 1982 GATT Ministerial produced only an agreement that member countries would voluntarily prepare national studies of their service industries; although the United States had hoped for a decision that services would be part of the next trade round, none was reached. Nevertheless, the process of carrying out the national studies helped move the process along, in part because most of the industrialized countries found that they had greater strengths in the services than they had realized.

The U.S. study, the first to appear (at the end of 1983), laid out this country's position:[5]

- the principle of national treatment should govern services trade;
- negotiators should seek greater transparency in regulations and trade barriers;
- GATT members should offer opportunities for comment on proposed laws or rules affecting services trade; and
- the talks should include mechanisms for settling disputes.

National treatment implies the right of foreign firms to market access sufficient for them to do business. If they are legally required to establish offices or local production facilities—e.g., to sell insurance—then national treatment is equivalent to right of establishment. More broadly, national treatment means treating foreign and domestic firms alike. The principal of *transparency* means that rules should be explicit. As a first step, parties to the multilateral trade negotiations (MTN) might make known policies and practices that regulate or limit access to their markets, creating a basis for negotiations aimed at reducing barriers and otherwise liberalizing trade and investment. Finally, the United States argued that, to function effectively, GATT codes covering services would have to be accompanied by agreement on procedures for resolving disputes. These principals have remained central to the umbrella agreement that the United States seeks. Box CC discusses the special problems of barriers to foreign investment—unavoidable given that it takes a local presence to supply many services.

By the end of 1983, both Japan and the European Community (EC) had become more receptive to discussion of services in GATT. The remaining opposition centered in a group of industrializing countries. In the fall of 1985, a year later than originally scheduled, another GATT Ministerial Meeting reconsidered the services issue in light of the national studies. At this meeting, Brazil, Yugoslavia, Argentina, and India led a coalition of developing countries opposed to including services—and especially banking, insurance, and the high-tech-

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[4] See B. Hindley, "Economic Analysis and Insurance Policy in the Third World," Thames Essays No. 32, Trade Policy Research Centre, London, 1982. In assessing the benefits of greater international competition in insurance, Hindley acknowledges the need for regulations to protect policyholders. He argues that foreign firms should be allowed into local markets, perhaps with special safeguards; as they import their own knowledge and expertise (i.e., technology), thereby exerting competitive pressures on local firms, the latter will be forced to become more efficient. In essence, Hindley advocates conditional admittance to developing economies for multinational firms, coupled with national treatment once they have been admitted. (National treatment implies the same rules for all firms doing business within the country, irrespective of ownership.) Any discrimination would then attach to the conditions of entry.

[5] "U.S. National Study on Trade in Services," A Submission by the United States Government to the General Agreement on Tariffs and Trade, Prepared Under the Direction of The Office of the United States Trade Representative, Washington, DC, December 1983.

Box CC.—Where Do Agreements on Foreign Investment Fit?

No set of international agreements covers direct investment, although a start was made during the Tokyo MTN Round, completed in 1979. Since its inception in 1947, negotiations and agreements within GATT have centered on trade in tangible goods. At first, the goal was reduced tariff levels. During the Tokyo Round—the seventh held under GATT auspices—attention shifted to NTBs, primarily as they affect merchandise trade. In general, the codes negotiated in the Tokyo Round were weakly worded; none have been signed by a majority of the 92 GATT members.[*] Only the subsidies code touched on investment issues, in a context of state aid for capital investment.

Agreements within the Organization for Economic Cooperation and Development (OECD) do cover direct investment. The 24 OECD members include the primary *exporters* of services—the United States, Japan, the major Western European economies (ch. 2)—but not the less developed countries (LDCs), which tend to be net importers of services. Many of the LDCs have strongly held reasons for seeking to regulate or restrict foreign direct investment (FDI).

Depending on their objectives, governments may limit FDI to protect domestic industries, permit inward investment (while perhaps setting minimum employment levels, or requiring that some of the resulting output be exported), or offer incentives to attract foreign firms. The possibilities are not mutually exclusive; over the past two decades, LDC governments have become more sophisticated and more aggressive in bargaining with multinationals on such questions (ch. 6). Sometimes they offer investment incentives to steer resources to favored sectors—low interest loans or tax holidays, below-market leases on buildings or land, manpower training grants that reduce operating costs for the foreign firm. Government agencies may provide assistance in site preparation, build roads and ports, offer preferential access to foreign exchange, or protect the market to be served through tariffs or NTBs. Such policies are common throughout the world, not excluding developed countries and many States within the United States.

Sometimes a country may wish to encourage firms that will compete with importers; sometimes, export-oriented industries will be preferred. Many governments combine selective investment incentives with performance requirements that constrain the actions of foreign investors in a manner consistent with the country's desires. For example, a multinational corporation (MNC) might be forced to accept a joint venture with a local firm, perhaps in a minority position, as a condition for entry. Or the foreign investor might be directed to purchase from domestic suppliers—e.g., through local content rules. Numerous variations on such schemes are possible, limited mostly by the imaginations of government officials.

Because delivery of many services requires a foreign presence, negotiations on investment become a natural complement if not a necessary part of negotiations on services trade. But with governments in both LDCs and newly industrializing countries (NICs) viewing investment controls as an integral part of development strategy, negotiations will be contentious. Planning for the Uruguay Round has focused on investment controls as they affect trade flows—i.e., requirements for exporting some of the production resulting from the investment. Given this, the United States may well choose to pursue broader investment agreements in parallel forums (e.g., the OECD) and bilaterally.

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[*] More GATT members, 35, subscribed to the standards code than to any other. The subsidies codes attracted 34 signatories, while 21 have signed the procurement code. Some countries have accepted codes but not yet formally signed. See R.M. Stern, J.H. Jackson, and B.M. Hoekman, "An Assessment of the Implementation and Operation of the Tokyo Round Codes," University of Michigan, 1986, p. 123. The subsidies and government procurement codes were drafted to cover services as well as goods.

On the effectualness of GATT, see G. Putka, "GATT Knows Who The Trade Sinners Are, But It Doesn't Matter," *Wall Street Journal*, Jan 2, 1985, p. 1; also J. Hein, "What Will the GATT Beget?" *Across The Board*, September 1985, p. 29.

nology information-intensive services—in the new round.[6]

Developing countries were particularly concerned that they would be asked to make concessions on imports of services, even though the United States, the EC, and other advanced countries had erected new barriers against their goods, sometimes in violation of earlier agreements. Among these barriers, the opponents cited the increasingly restrictive Multi-Fiber Arrangement, voluntary restraints on shipments of steel, and more vigorous enforcement of anti-dumping and countervailing duty laws. The LDCs and NICs argued that these new barriers should be rolled back before another MTN round began. They also wanted assurances that services liberalization would not disrupt domestic banking sectors and fledgling high-technology markets. Pointing to the absence of existing GATT jurisdiction over services, the opponents tried to switch discussion to forums they regarded as more favorable to their interests—e.g., the United Nations Council on Trade and Development (UNCTAD) or the United Nations Industrial Development Organization (UNIDO).

As a group, the industrial countries responded that they needed to expand their exports of services if they were to accept a continuing flow of goods from the developing world. But not all the industrial countries were unhappy with the opposition. A number had managed to establish and maintain a strong foreign presence in services such as banking and construction despite NTBs intended to keep them out. Those that had jumped the barriers—the French in Francophone Africa, the British in their former colonies in Africa, the Japanese in Southeast Asia—now had a stake in preserving these barriers to exclude other competitors.

Still, the primary resistance came from the developing countries. These, in the end, had little option but to come to the table.[7] By late 1985, the members of GATT had agreed to start a new MTN round in September 1986. At the September meeting in Punta del Este, Uruguay, GATT members hammered out a declaration on the new round. Although the United States got much of what it wanted in the September 1986 declaration, negotiations on services will proceed on a separate track from those on goods—a concession to the countries that remain opposed to discussing services.[8] The negotiating group on services will report to the same overall committee as that on goods. When the two sets of deliberations have been completed, a special session of the parties to GATT will be held "regarding implementation of the respective results." The talks on services may also move on to sector-specific matters.

Why did it take 4 years of sometimes acrimonious debate to reach this point? Largely because the various countries defined their interests differently, with prior choice of development strategy perhaps the single most important factor.

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[6] A group of 10—also including Cuba, Egypt, Nicaragua, Nigeria, Peru, and Tanzania—consistently opposed GATT negotiations on services. See W. Dullforce, "Compromise Boosts Chances for New Gatt Round," *Financial Times*, July 21, 1986, p. 2. The EC did not formally endorse services trade negotiations until March 1985. Japan was quicker to support the new round, no doubt hoping to deflect attention from its continuing bilateral trade surpluses.

[7] As continuing opposition—spearheaded by Brazil and India—led to a more confrontational tone on the American side, U.S. Trade Representative Clayton Yeutter was quoted as saying, "We simply can't afford to have a handful of countries, responsible for 5 percent of world trade, dictate the destiny of a large number of countries who deal with 95 percent of that trade." See S. Auerbach, "Yeutter Hits Blockers of Trade Talks," *Washington Post*, Nov. 15, 1985, p. E1. Ten months later, the United States was still threatening to walk out of the trade talks if other countries did not agree to its proposals—S.J. Paltrow, "Trade Aides Fail To Narrow Differences Prior to the New Round of GATT Talks," *Wall Street Journal*, Sept. 8, 1986, p. 30. As part of their counterattack, U.S. officials began to suggest that it might prove difficult to renew the Generalized System of Preferences if the LDCs and NICs continued to block the new round.

[8] For the text of the declaration, see "Ministerial Declaration on the Uruguay Round," attachment to "Testimony on the Results of the GATT Ministerial," Ambassador Clayton Yeutter, United States Trade Representative, before the Subcommittee on Trade, Committee on Ways and Means, U.S. House of Representatives, Sept. 25, 1986.

HOW NATIONS THINK ABOUT THE SERVICES

At some risk of caricature, the ongoing debate concerning the role and importance of services can be summarized in terms of two extreme views. The first—call it the post-industrial view—holds that services are displacing the primary (agriculture/mining) and secondary (manufacturing) sectors in all the Western economies. Not only are service firms creating most of the new jobs and wealth, but this must be counted a good thing because jobs in the primary and secondary sectors are hard, dirty, and dangerous, while service work tends to be pleasant and to pay well (at least in the professions). People of this persuasion see no cause for concern in relative or absolute expansion of the services. In fact, they see this expansion as a welcome development, part of the transition from old industrial societies to a new and better post-industrial future.[9]

Those holding the opposing view—deindustrialization—believe that the developed economies rest on a foundation of manufacturing. Expanding textile, steel, and automobile production created wealth and employment in the past, and high-technology goods will be the basis of new wealth and employment in years to come. Adam Smith, who held the services to be parasitical, was right: the growth of the services signifies weakness, an eroding industrial base. Evidence for this proposition includes the continuing high proportion of manufacturing in Japan's rapidly expanding economy. Proponents of the deindustrialization thesis point to the long-lasting distress created by layoffs and plant closings in societies that failed to protect their manufacturing base—Britain being the preeminent example. There, many firms in declining, traditional sectors have closed or contracted, unemployment remains high, foreign manufacturers continue to win larger shares of the market, while most of the new jobs lie in low-wage, tertiary services.

The post-industrial and deindustrialization theses cannot both be true. But both could prove false, at least in their oversimplified forms. OTA's analysis, which stresses the ties between services and manufacturing—particularly in the cluster of industries that share a strong dependence on information technologies—suggests alternative paths. Computer and communications technologies help firms cut costs and pursue new competitive strategies, as discussed in chapter 8. In so doing, they accelerate processes of economic growth and structural change. They also accelerate the need for adjustment. For the United States, then, the question is not so much a matter of post-industrialization or deindustrialization; the questions become: What set of internationally competitive industries will emerge once the U.S. economy has passed what Piore and Sabel call an industrial divide?[10] What rates of growth in national income, living standards, and employment will accompany the transition from one dominant mode of doing business to another?

No one knows what the new industrial structure will look like, in the United States or elsewhere, but economic actors must make assumptions and place their bets. Certainly in Japan, the officials who staff agencies like the Ministry of International Trade and Industry (MITI) share a vision of the future in which information-based technologies will have great strategic significance, and knowledge-intensive services will account for a large share of Japan's gross national product. Most of the members of the EC have likewise begun to act on the belief that computers and communications systems will be critical in preventing further widening of the technological and competitive gaps separating them from the United States and Japan. Nonetheless, for the European countries, as for the United States, worry over job-less growth and other pieces of the deindustrialization picture cloud visions of the future.

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[9] Perhaps needless to say, Daniel Bell pioneered this first perspective in *The Coming of Post-Industrial Society* (New York: Basic Books, 1973). The best-known statement of the second view, below, is B. Bluestone and B. Harrison, *The De-Industrialization of America* (New York: Basic Books, 1982).

[10] M. Piore and C. Sabel, *The Second Industrial Divide* (New York: Basic Books, 1984).

The new profile is hard to make out, if for no other reason than that nations ranging from Britain to the United States to Japan are somewhere in the midst of a process that may end in a period of slower paced change, but probably will not.

Development Strategies

To policymakers in the developing world, the services have rarely seemed cause for either optimism or concern. While governments everywhere pay attention to industries like banking, relative to other economic problems in the LDCs, the service sector as a whole has simply not been important. Still, a number of countries further along the development path—NICs like Brazil, Mexico, South Korea, Taiwan, and India—have begun to promote domestically based high-technology industries, with products that depend on service inputs (e.g., knowledge and information). Some of the favored business ventures have been nominally goods-producing (computer peripherals), others services-producing (data entry, software). The NICs, then, tend to see growth in the services—and especially in the high-technology services—as a necessary part of overall development strategy. Wary of concessions that might expose their emerging industries to external competition, they perceive liberalization in the services as threatening their interests.

Development strategies, despite many variations, tend to align themselves with one of two fundamental approaches: 1) import substitution; and 2) export-led growth.[11] Import substitution begins with high trade barriers to create a sheltered domestic market; the goal is to help otherwise uncompetitive enterprises gain a foothold and begin to grow. In contrast, economies pursuing export-led development tend to have lower protective barriers—or at least less obvious barriers—relying instead on subsidies and other supports to nurture export-oriented firms. With export-led development, the faster growing businesses will typically be found in industries where the country has a comparative advantage. If it is rich in low-wage labor with adequate basic skills, many of the new businesses will be in manufacturing; arable land and a suitable climate favor agriculture.

Very generally, the Latin American NICs tend to be import substituters, while those in Southeast Asia have pursued export-led growth. Among the Asian nations, India looks more like Brazil in terms of its development strategy than Singapore or Malaysia. Needless to say, many combinations of import barriers and subsidies can be found in particular countries.

Nations following import substitution policies will normally oppose liberalization of services trade because this means lowering barriers viewed as necessary for development. This is plainly the case with Brazil. Of course, some domestic interest groups may favor reductions in trade barriers. In Brazil, firms that use telecommunications services in their own businesses would like to see fewer restrictions, as would many purchasers of computers (box N in ch. 5); nevertheless, those favoring a more open market have had little success against the combined forces of nationalist political groups and Brazilian companies dependent on protection.

Export-led developers should be more favorably disposed; liberalization, bringing better access to business services, could help the competitiveness of their manufacturing industries. Some of the service providers in these countries would no doubt prove able to compete internationally. But NICs that have been following an export-led strategy may wish to continue protecting domestic banks (which help provide financing for export-oriented manufacturers), as well as infant high-technology service industries (e.g., software in Singapore and Hong Kong). Although export-led strategies have generally proven more successful than import substitution, the Asian NICs face real difficulties in deepening their economies. Many of these countries will probably continue to go along quietly with those seeking to delay meaningful liberalization of trade and investment in the services.

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[11] The discussion following owes much to S. Haggard and C.-I. Moon, "The Korean State in the International Economy: Liberal, Dependent or Mercantile," *The Antinomies of Interdependence*, J. Ruggie (ed.) (New York: Columbia University Press, 1983). Also see *National Policies for Developing High Technology Industries*, F.W. Rushing and C.G. Brown (eds.) (Boulder, CO: Westview, 1986); and *International Competitiveness in Electronics*, op. cit., pp. 383-389.

High Technology and the Promotion of Innovation

The contrasting views of the future of industrial society outlined above explain some of the squabbling leading up to Punta del Este. Beyond the more abstract debates over development strategy, post-industrialism, and deindustrialization, many governments are beginning to pay more attention, in a practical sense, to the linkages between services and the rest of their economies. For instance, telecommunications issues such as pricing and TBDFs have excited interest in both industrial countries and the NICs (box DD). To policymakers, the infrastructural role of telecommunications has come to seem a pre-condition for development paralleling in significance the networks of railroads and highways of earlier years. Many governments have provided support for information-related technologies believing that this would contribute to development and competitiveness throughout their economies.

Policymakers seeking to promote innovation can choose from a long list of tools. But effective choices depend on a policymaking system that enables government to formulate and implement policies with some consistency. In most of the countries that have developed such systems—typically through often-painful learning and experience (e.g., in Japan)—the industrial policy apparatus is relatively centralized. With only a few agencies involved, and with political traditions that grant powerful tools to government—subsidized loans, control over access to import licenses, funding for development of proprietary technologies—industrial and technology policies can be coherent and targeted. (Of course, consistency is not always a virtue; many governments have stuck too long with bad ideas.) Table 46 summarizes some of the similarities and differences in approach to technology policy in five major industrial countries.

Japan

If centralized institutional arrangements for industrial policies carry substantial risks—i.e., failure to recognize mistakes and abandon un-

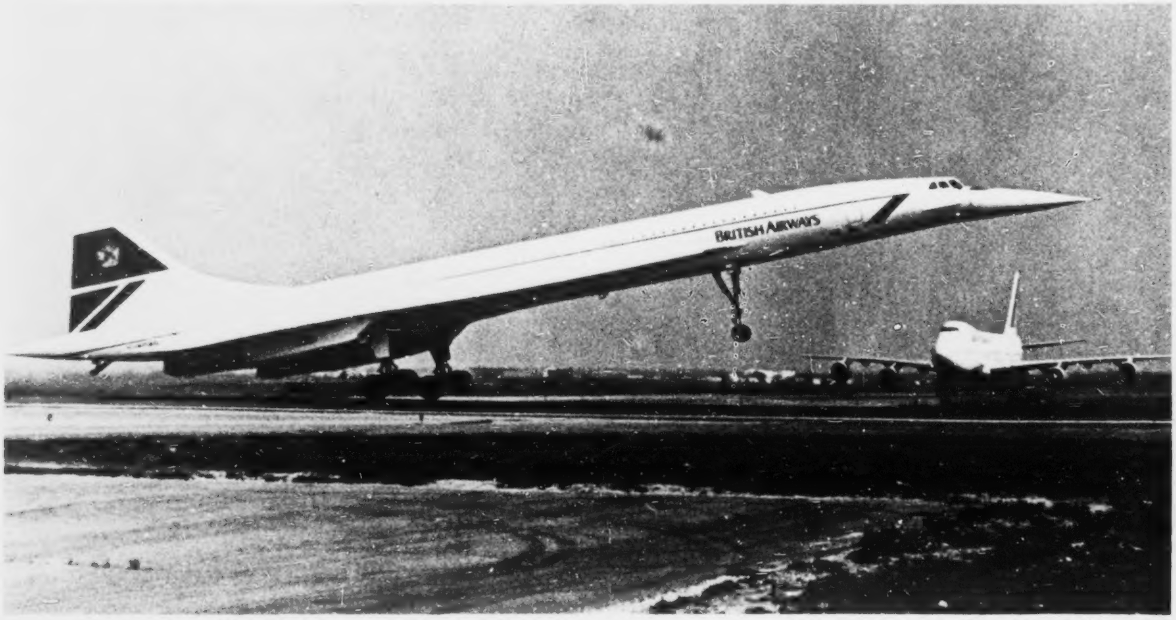

Photo credit: British Airways

Governments have often played major roles in aircraft manufacturing (e.g., for the Concorde, pictured here) as well as in air transportation.

Box DD.—Transborder Data Flows and Related International Telecommunications Issues[*]

Frequently cited examples of government restrictions on transborder data flows include Brazil's limits on access to foreign databases and West Germany's local processing requirements (ch. 5). The latter force companies that supply remote data processing and information services to carry out a portion of the associated computing within the Federal Republic. Some observers also cite U.S. restrictions on data communications between Dresser Industries and its French subsidiary during the Siberian pipeline dispute of 1982.

Since the middle 1970s, the Organization for Economic Cooperation and Development has been the primary forum for discussing TBDF restrictions. Governments have tended to rationalize their TBDF policies and proposals in terms of concern for personal privacy, in contexts ranging from credit ratings to medical records. Much of the early work by the OECD staff explored the issue in this context. But it soon became clear that TBDFs should be viewed more broadly, as a new form of protectionism and a possible revenue source for governments.

Customs duties on data or information—one form of TBDF restriction—raise the question of determining value. While potentially controversial, valuation of data flows may in the end be more important for measuring trade volumes than in relation to possible trade barriers. The problems of establishing the value of information are compounded when the information moves between divisions of a multinational enterprise. Just as for royalties on licensing agreements, an MNC may charge subsidiaries either more or less than the prices that would be set in a market transaction. To the multinational, such charges can become a useful means for transferring funds internationally.

Beyond the question of customs valuation lies a narrower issue, one of far greater near-term significance: tariffs (pricing) for international telecommunications. In the past, tariff structures have commonly been based on connect-time—the elapsed time for transmitting a message, regardless of the volume of data transmitted. More recently, some countries have proposed or implemented tariffs based on the volume of information (as measured, for example, by the number of bits of digital data). This is partly a consequence of the transition to packet switching. A packet-switched telecommunications system breaks down messages—voice as well as digital data—into short bursts, or packets. The packets can be sent independently of one another (i.e., over different circuit paths); they are reassembled at the receiving end. With independent routing of the packets, circuit paths can be utilized to their full capacity (avoiding, for example, dead time because of pauses in any one message). Because each packet must be tracked during transmission, it is an easy matter to base charges on the number of packets sent, rather than the time required to transmit the message.

Volume-based pricing has been an attractive prospect for some PTTs (post, telegraph, and telephone authorities), particularly those that view faster speeds for data transmission as taking money from their pockets. Many PTTs see the added revenues from volume-based tariffs as a help in subsidizing postal services, in paying for investments in infrastructural improvements like ISDN (Integrated Services Digital Networks, ch. 5), or for diversifying into value-added services. Any large-scale movement toward volume-based tariffs, however, would mean substantial disruptions in an international system which has grown and prospered under time-based pricing, closely related to actual costs. Time-based pricing has created strong incentives for innovations that increase transmission speed. A shift to volume-related pricing would move the system away from cost-based prices. It would also radically alter the incentives for innovation, slowing the pace of technological advance in telecommunications-related services and equipment, while making a good deal of existing technology, particularly customer premises equipment, obsolete. Beyond this, movement toward volume-based pricing could greatly increase costs for some users of the international telecommunications infrastructure. MNCs and other major customers have understandably been concerned that PTTs might use their monopoly positions to raise tariffs arbitrarily, upsetting corporate investment plans. Given that regulators in the United States have avoided volume-related pricing, and that American firms have come to depend on pricing is a function of connect-time only, the U.S. Government may find itself needing to defend the interests of American companies in both bilateral and multilateral negotiating forums in the years ahead.

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[*] The best single summary of TBDF issues remains I. de Sola Pool and R.J. Solomon, "Transborder Data Flows: Requirements for International Co-Operation," *Policy Implications of Data Network Developments in the OECD Area* (Paris: Organization for Economic Cooperation and Development, 1980), pp. 79-139. Also see J. Bortnick, "International Data Flow Issues," Congressional Research Service Issue Brief IB81040, Apr. 19, 1985. For a summary of the activities of a dozen international bodies, see K.P. Sauvant, *Trade and Foreign Direct Investment in Data Services* (Boulder, CO: Westview, 1986), app. C.

Table 46.—Technology Policy in Five Industrial Countries

	Reliance on industry-specific measures	Centralization within government	Reliance on defense spending
United States	low	low	high
Japan	high	high	low
Federal Republic of Germany	low-medium	medium	low
France	high	high	high
United Kingdom	medium	low-medium	medium

SOURCE: Office of Technology Assessment, 1987

promising avenues—Japan, preeminently, has evolved a policymaking system that seems both centralized and effective.[12] In recent years, MITI has had to share some of its power with other agencies—e.g., the Ministry of Posts and Telecommunications—but policymaking authority remains concentrated in comparison with most other advanced industrial economies. The Japanese Government no longer uses direct subsidies or control over import licenses to persuade firms to move in particular directions. Nevertheless, through measures such as incentives for joint development of new technical know-how, the government has helped Japanese firms reach the technological frontiers (perhaps the best-known example being the VLSI project of the late 1970s). At the same time, Japan's Government has taken advantage of fierce rivalries among the nation's industrial groups, or *keiretsu*, to assure that domestic competition remains a spur to competitiveness even as firms share some of the work of technology development.

United States

The United States also promotes technology development, but—preferring the hurly-burly of political competition to the competition of ideas—does so using different methods. As discussed in chapter 6, military funding provides most of the government push for technology development. Health-related spending is a distant second. In comparison with Japan and the EC, Federal agencies support little commercially oriented R&D.

Widespread support for university research, coupled with R&D funded by the Department of Defense (DoD) in the larger aerospace and electronics firms, and in Federal laboratories, have created an unmatched scientific establishment and an equally unmatched array of high-technology military systems. With some exceptions, neither the science base nor the military technologies have been very closely linked to the needs of commercial firms; today, the increasing specialization of mission-oriented military R&D throws even the theoretical possibilities for strengthening such linkages into doubt.

Defense spending has biased U.S. strengths in the direction of technologies with at least a dual-use nature: commercially, the United States generally does best where technical knowledge can be adapted to civilian as well as military applications. Noting again the exception of medical research (which has laid many of the foundations for biotechnology),

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[12] For a review of both process and substance in Japan's approach to high technology, see *International Competitiveness in Electronics*, op. cit., pp. 413-422.

U.S. excellence in aircraft, computers, space technology, and telecommunications has depended in part on complementarities between military and civilian technologies. These complementarities will diminish as defense systems become more exotic and competition in civilian technologies from countries like Japan grows more intense. The trends are plain in both the aircraft and electronics industries, where military and civilian technologies have been diverging for 25 years and more. In the future, spillovers from military R&D will have still weaker effects in stimulating internationally competitive civilian industries.

Europe

Despite earlier scares over technology gaps, only since the beginning of the 1980s have the EC nations grasped how far they were falling behind the United States and Japan. While many European governments have traditionally supported technology development, the EC Commission has also begun to channel substantial funding in this direction. Planning began in 1982 for the ESPRIT program (European Strategic Program for Research in Information Technology, box EE), which supports work in computers and information technology. ESPRIT has been followed by RACE (R&D in Advanced Communication-technology for Europe), BRITE (Basic Research on Industrial Technologies for Europe), and Eureka—this last intended to be closer to commercial technology development than ESPRIT.

Current plans call for all the Eureka money to come from national governments and the companies involved, rather than the EC budget. The Europeans have held that U.S. military spending amounts to a subsidy for American high-technology industries. With the French, in particular, claiming that the Strategic Defense Initiative (SDI) would become a technological cornucopia for American firms, Eureka emerged in part as a counter to SDI spending. Recent signs suggest that the Europeans are beginning to appraise the benefits of military R&D more realistically.[13]

Most of the Community's members have well-established industrial policies of their own, with responses to the technological challenges, especially of Japan, that span a considerable range. (While Europe has in many respects learned to live with U.S. investments and exports, Japan's successes, many of which have come at the expense of European more than American manufacturers, have provoked new anxiety.) West Germany, for instance, pursues its technology policies mainly through the Ministry of Research and Technology (the German acronym is BMFT), which relies heavily on direct R&D subsidies. Over the years, BMFT programs designed to promote information technologies—focusing primarily on mainframe computers and microelectronics—have met with limited success at best.[14] While the BMFT has recently given more attention to telecommunications and software development, a hardware bias still seems to characterize the programs of both the government and of major (and favored) firms like Siemens.

French policies have been more imaginative, as illustrated by the Teletel/Minitel system described in chapter 5. In its policymaking system, France resembles Japan more than Germany or the United States. But while Japan spends little on defense-related R&D, France relies heavily on military spending to stimulate technology development; although the French Ministry of Research and Industry is the center for industrial and technological policymaking, defense planners have a strong voice (and not just because of the funds they command).

While direct subsidies like the Alvey program (box EE) have been common in the United Kingdom, the British Government exerts less control over the fate of firms and industries than is the case in France. As in France and the United States, relationships between the government and defense contractors have been central to Britain's technology policy. In both the United Kingdom and France, large firms—many with commercial interests in computers and telecommunications—get substantial pro-

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[13] P. Lewis, "Military Spending Questioned," *New York Times*, Nov. 11, 1986, p. D1.

[14] *International Competitiveness in Electronics*, op. cit., pp. 405-412.

Box EE.—ESPRIT and Alvey: Two European Technology Development Programs

ESPRIT's 200 current projects are pointed at pre-competitive R&D—well before the stage of commercial development. By drawing a line upstream from commercialization, the program seeks to avoid overlap or conflict with ongoing R&D funded by national governments or by participating companies. The ESPRIT schedule calls for $1.3 billion in funding over the period 1984-89. A dozen large companies carry out much of the research in five principal areas: microelectronics, software, advanced information processing, office automation, and computer-integrated manufacturing. At the same time, program requirements call for each project to involve participants from at least two EC countries, so that several hundred smaller firms also take part. So do more than a hundred universities and nearly as many research institutes. The program aims not only at developing technology, but, by encouraging cooperation, at changing the relationships among firms in Europe as one step toward a more truly common market. Whether it will succeed in this latter objective remains to be seen.

Britain's Alvey program—named for the chairman of the committee that recommended it—represents an explicit response to Japan's fifth-generation computer effort (ch. 5). Beginning in 1984 and planned for 5 years and a total budget of $525 million, Alvey supports individual projects chosen on a competitive basis. The Department of Trade and Industry, which is responsible for program management and overall coordination, contributes the major share of government financing, along with the Department of Education and Science and the Ministry of Defense. Alvey funds go toward five principal types of research:

- computer architectures;
- very large-scale integrated circuits (VLSI);
- expert or knowledge-based systems, a form of artificial intelligence (AI);
- man/machine interfaces (which includes other AI work); and
- software engineering.

Alvey's software engineering R&D is aimed quite directly at increasing the international competitiveness of British industry; a stated objective is "to establish tools and methods necessary for the production of high quality, cost effective software of world leading standard."* To aid in this, a portion of the budget has been set aside for diffusing technology to industry.

With 300 projects involving more than a hundred companies and almost all of Britain's universities, often in partnership with industry, the program's directorate has struggled with problems of coordination—as well as with evaluation of project proposals—in an effort to make Alvey add up to something more than the sum of its parts. Good proposals have been scarce in some technical fields, leading the directorate to take an active role in encouraging formation of project teams. Elsewhere, notably for work related to VLSI microcircuitry, large numbers of proposals have been received and funded; nearly half the money committed through mid-1985 went toward VLSI R&D.**

Evaluating such a program shortly after its halfway point can be unfair as well as misleading, but Alvey does seem to be overemphasizing hardware, and particularly integrated circuits, at the expense of software and applications. In part, this reflects the predilections of British research scientists and engineers, far more of whom have worked on hardware problems than software in the past. Even more, as a research program—and again despite the efforts of its managers and the objectives set down so frequently in program documents—Alvey seems in danger of following the path of its many predecessors: giving research a boost without finding ways to translate the results into meaningful help for industry.

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*D.E. Talbot, "Alvey Software Engineering—A Strategy Overview," Alvey Directorate, London, Department of Trade and Industry, no date, p. 1.

**"Chips Take Lion's Share of Alvey Cash," *Financial Times*, June 18, 1985, p. 6. Also, D. Fishlock, " 'Tripe' To Describe Alvey Programme As Just Academic," *Financial Times*, Nov. 4, 1986, p. 10.

The EC's ESPRIT program has also budgeted more money for microelectronics than any of its other four areas, but ESPRIT looks considerably better balanced than Alvey. The ESPRIT allocations: microelectronics, 23.5 percent; advanced information processing, 22.8 percent; office automation, 21.9 percent; software, 18.9 percent; and computer-integrated manufacturing, 12.9 percent—H. Hunke, "Updating the European Strategic Program in Information Technology (ESPRIT)," presented at the Artificial Intelligence Conference, London, Apr. 14-15, 1986.

portions of their revenues from military contracts and have become primary agents of technology promotion.

R&D Supports and Subsidies

As pointed out in box B (ch. 1), service industries depend on much the same technology/science base as manufacturing. Interdependencies are many: for example, the design of telecommunications equipment will be a function of the services to be provided. But with the exception of the information-related industries, services remain close to invisible in the industry/technology policies of most countries (as opposed to their regulatory policies). Indeed, governments seldom collect meaningful statistics on R&D in the services (see box FF); many—including the U.S. Government—barely seem to recognize that service companies conduct product and process development projects much like those found in manufacturing firms.

When it comes to telecommunications and related industries, governments have paid far more attention to the development of new equipment than new services; often when they have promoted services, governments have done so to support related manufacturing sectors. Thus in the 1950s, Japan rapidly expanded its television broadcasting to help build domestic sales from which the country's consumer electronics industry could gain strength before moving into export markets.[15] Nor are programs like ESPRIT and Alvey (box EE) new; indeed, they can be viewed as responses to government projects elsewhere.

In the 1960s and 1970s, governments in Europe and Japan sought to help their computer industries catch up with American firms. In the latter part of the 1970s, microelectronics technologies rose to the top of priority lists. In large measure, the microelectronics thrust in ESPRIT represents a European response to Japan's earlier VLSI project. The same is true of France's Plan des Composants, and the Philips/Siemens Megabit project, while Japan's fifth-generation computer project (ch. 5) has been met by the software and AI portions of ESPRIT and Alvey. In the industrial policy equivalent of an arms race, escalating expenditures for high technology have culminated in very large efforts like Eureka and France's multi-billion dollar Filiere Electronique. Those in Europe who see military spending as central to U.S. technology policy might wish to add SDI to the list. But it is Japanese rather than American efforts that have stimulated most of these reactions.

Nonetheless, in Japan—with the uncertain exception of the ISDN Information Network System project—MITI and other government agencies have generally funded technology development at relatively low levels. Programs like ESPRIT and Alvey support many individual projects, chosen competitively. Japanese industrial policy provides money for a wider variety of projects, with extensive efforts to maintain coordination (although many in the West have overstated the degree of cooperation among Japanese firms).

Table 49 illustrates in terms of MITI's projects (only) for information-related technologies (only) during 1985 and 1986. Tax incentives, some of which are substantial, have not been included. Omitting the loan funds that are listed, the 1986 total does not reach $400 million. MITI's support, then, is noteworthy more for the diversity of projects than for the money provided. The Japanese approach has evolved over many years of experience in supporting technology development. No list even remotely similar in range could be compiled for any U.S. Government agency; indeed, even if *all* U.S. Government agencies were surveyed, the results in terms of comprehensiveness and attentiveness to industrial development needs would pale alongside table 49. Recent history also suggests that Japan's approach works better than the European efforts described earlier.

The military thrust of U.S. R&D programs compared to those of other countries, and especially Japan, raises real questions for the Nation's technology policy. The Japanese need not devote resources to the design and production of integrated circuits that can withstand the

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[15] Ibid., pp. 119-121 and 180-182. Many countries have also used broadcasting standards as NTBs to shelter their domestic industries from foreign TV manufacturers.

Box FF.—How Much Does the United States Spend on Services R&D?

To the casual observer, R&D in U.S. service industries must seem nearly invisible. The National Science Foundation's (NSF) biennial *Science Indicators* series—the primary U.S. Government compilation of R&D statistics—hardly mentions the services. A few summary tables suggest that non-manufacturing industries account for 3 to 4 percent of U.S. spending on industrial R&D—a little over $2 billion currently.[*] Table 47 summarizes the NSF figures, which ~~are~~ much too low to be realistic.

Many activities of service firms fall outside NSF's definitions of R&D, which have been oriented toward manufacturing companies. At the same time, many service firms—even those that for years have budgeted substantial sums for the development of proprietary technology—do not think of what they do as R&D, at least in self-conscious or systematic fashion. For example, product development departments in banks are new, as pointed out earlier in this report, even though they may simply represent a reorganization of existing functions. The extraordinarily low figures in table 47, then, reflect underreporting of R&D expenditures for largely historical reasons—much like the underreporting of exports and imports of services in the U.S. current account (i.e., collection and reporting of data under obsolete or unexamined rules). NSF does plan somewhat broader coverage of services in its next survey, to be conducted in 1988.

What would a more realistic estimate look like? The very large size of the service sector of the U.S. economy suggests that, even if few service firms spend more than a fraction of a percent of sales on R&D, the total must be substantial. And in fact, some service companies allocate several percent of sales to such activities (although others spend little or nothing).[**] Data on R&D spending as a percentage of sales provides the basis for sectoral estimates carried out at Battelle Memorial Institute and included in Battelle's recent R&D forecasts.[***] Using an input-output model, Battelle's procedure yields estimates of R&D by line of business—regardless of the nominal sectoral classification of the firm conducting the R&D. The result is a series of estimates for services-related R&D, some of it conducted by firms otherwise classed in manufacturing industries. (Some of these firms produce services as well as goods; others sell to service firms and carry out services-related R&D to support this portion of their business.) Table 48 gives Battelle's estimates for the 10 largest industry sectors in terms of sales, as well as summary figures for all of U.S. industry. While the figures for individual sectors should be seen as only rough approximations, the table as a whole gives the best picture of services-related R&D spending that OTA knows of.

As table 48 indicates, the services, as a whole, spend only 0.7 percent of sales on R&D—compared with more than 2 percent for the goods-producing portion of the economy. But the services total reaches $26 billion, more than 10 times greater than the NSF figures for non-manufacturing industries in table 47. (Battelle's services total comes to about one-quarter of industrial R&D, and one-fifth of the $127 billion forecast for all U.S. R&D in 1987, including that performed by government, universities, and nonprofit laboratories.) This $26 billion figure seems a reasonable estimate for total services-related R&D spending in the United States—a sum suggesting that R&D in the services is far more important than has been commonly appreciated. (To OTA's knowledge, no estimates comparable to those in table 48 exist for other countries.)

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[*] According to the most recent edition of *Science Indicators*, more than half of this R&D takes place in the following R&D-performing non-manufacturing industries: electric, gas, and sanitary services; computer and data processing services; miscellaneous business services (including R&D laboratories and computer software firms); and engineering, architecture, and surveying. See *Science Indicators: The 1985 Report* (Washington, DC: National Science Board, 1985), p. 78. Health services go unmentioned, although the 1986 Federal budget figure for health-related R&D of $5.1 billion can be found on p. 227. Much of the health services industry consists of not-for-profit institutions, presumably excluded from summary figures for "R&D-performing non-manufacturing industries." But the primary point is that spending on health-related R&D is nowhere associated with a major identifiable service sector. The same is true for education.

NSF's definition of development, referred to below, reads as follows: "systematic use of the knowledge or understanding gained from research, directed toward the production of useful materials, devices, systems or methods, including design and development of prototypes and processes" (p. 221). Given this wording, a good deal of R&D directed at new service products and processes *should* qualify.

[**] See K.J. Freeze and R.S. Rosenbloom, "Banc One Corporation and the Home Information Revolution," Harvard Business School Case Study 9-682-091, 1982, for discussion of R&D in a bank that allocates 3 to 5 percent of earnings to R&D—several million dollars annually. Should the 3 percent be representative for the banking industry as a whole, annual R&D spending by U.S. banks alone would approach $500 million. Manufacturing firms typically spend in the range of 1 to 10 percent of sales on R&D, with industries like primary metals (e.g., steel) near the bottom, and high-technology sectors like computers near to the top.

[***] *Probable Levels of R&D Expenditures in 1987: Forecast and Analysis* (Columbus, OH: Battelle Columbus Division, December 1986), pp. 19-22.

Table 47.—U.S. Government Figures on Industrial R&D Spending[a]

	Expenditures (billions of current dollars and percentage of total)							
	1970		1980		1983		1986[b]	
Manufacturing industries (all)	$17.4	(96.1%)	$42.7	(95.9%)	$60.8	(96.7%)	$83.0	(97.4%)
Non-manufacturing industries	0.705	(3.9%)	1.82	(4.1%)	2.07	(3.3%)	2.26	(2.6%)

[a] R&D performed by private companies, including that paid for by the Federal Government. NSF reports Federal funding for R&D carried out by non-manufacturing industries at $0.779 billion in 1980, and $1.048 billion in 1983. The estimated 1986 figure is $1.092 billion.

[b] Estimated.

SOURCES: **1970, 1980, 1983**—*Science Indicators: The 1985 Report* (Washington, DC: National Science Board, 1985), pp. 253-254, 265. **1986**—*Probable Levels of R&D Expenditures in 1986: Forecast and Analysis* (Columbus, OH: Battelle Columbus Division, December 1985), p. 12.

Table 48.—Estimated 1987 R&D Spending by U.S. Service and Goods-Producing Sectors[a]

	R&D as a percentage of sales	Estimated 1987 R&D spending (billions of dollars)
Service sectors:		
Trade	0.44%	$ 3.39
Real estate	0.04	0.22
Residential construction	0.60	1.59
Finance and insurance	0.50	1.21
Nonresidential construction	0.60	1.41
Educational services	0.60	1.38
Other business/professional services	2.50	4.15
Top seven services	0.54%	$13.3
All services	0.73%	$26.0
Goods-producing sectors:		
Food production	1.0 %	$ 3.88
Motor vehicles	2.41	6.01
Petroleum refining	0.60	1.45
Top three goods-producing	1.29%	$11.3
All goods-producing	2.15%	$69.9
All U.S. industry[b]	1.36%	$98.5

[a] Only the 10 largest sectors, as ranked by sales, have been listed separately—7 service sectors, and 3 goods sectors. R&D expenditures include government-funded projects conducted by industry. Sector definitions do not necessarily correspond to those of the Standard Industrial Classification system. The all-services subtotal excludes public utilities. The all-goods-producing subtotal includes agriculture and mining.

[b] All services plus all goods-producing plus public utilities.

NOTE: Subtotals may not add because of rounding.

SOURCE: *Probable Levels of R&D Expenditures in 1987: Forecast and Analysis* (Columbus, OH: Battelle Columbus Division, December 1986), pp. 21-22.

electromagnetic pulse from a nuclear explosion, or to software for controlling a ballistic missile defense system. Will technologies from DoD's VHSIC (Very High-Speed Integrated Circuit) program, SDI, and the DoD Strategic Computing effort yield fruitful commercial spinoffs, such as benefited American computer and electronics firms in earlier years? The increasingly specialized nature of military technologies suggests skepticism. Rather than assuming that military spending will in some sense pay off in the civilian economy, U.S. policymakers might pay closer attention to programs like Japan's SIGMA or France's Teletel/Minitel—perhaps even to the extent of seeking to emulate some of their objectives.

Table 49.—Projects Related to Information Technology Supported by Japan's Ministry of International Trade and Industry

Description	Budget (millions of yen)[a]	
	1985	1986[b]
Robots for dangerous conditions (JUPITER)	1,900	2,450
Fifth-generation computing	4,780	4,500
High-speed computer	3,020	2,930
New-function integrated circuits	1,590	1,540
Reliability improvement for information equipment	—[c]	11,000[d]
Industrialization of software production (SIGMA)	—[c]	6,000[d]
Interoperative database technology	20	840
Survey on information processing in education	—[c]	220
Teacher education and training related to information technologies	—[c]	1,000[d]
Promotion of database and information services	10	110
Development of databases and information processing and communications systems	—[c]	7,500[d]
Support for smaller businesses:		
Information networks	30	370
Software	—[c]	200
Consulting	—[c]	440
Loans	—[c]	4,300[e]
Equipment leasing	—[c]	41.000
Planning and development of information systems for model communities	70	70
Survey on regional information systems	—[c]	10
Promotion and improvement of regional information systems	—[c]	4,000[e]
Development of standards	70	880

[a] Because of recent exchange rate shifts, fiscal year budget levels have been given in yen. For 1985, the average rate was 237 yen to the dollar. The rate dropped to an average of 167 yen to the dollar in 1986.
[b] Request.
[c] 1986 first year.
[d] Allocation for Japan Development Bank loans.
[e] Including loan funds.

SOURCE: "MITI's Fiscal 1986 Policy Measures Outline," *Japan Report—Science and Technology*, Joint Publications Research Service JPRS-JST-86-060-L, Aug. 29, 1986, pp. 84-99. Translated from *Nikkei Electronics*, October 1985.

OTHER POLICIES RELEVANT TO THE SERVICES

The remainder of this chapter adds more detail to the picture of development strategies begun earlier, covering several other policy tools listed in table 45. Chapter 10 turns specifically to U.S. policies and options.

Public Procurement

Government funds pay for heavy construction projects (ports, the Interstate Highway System). Telecommunications and data processing firms find some of their best customers in government agencies, as do computer software suppliers. In France, the government has begun to subsidize outside consulting services for small and medium-sized firms; the aim is to build demand for business services, while at the same time helping smaller French manufacturing companies adjust to changes in their markets.

As noted in chapter 5, preferential purchasing policies by Nippon Telegraph & Telephone (NTT)—until recently a public corporation—helped the company's suppliers improve their technology. Favored firms built large and capable organizations on the base of sheltered domestic markets created for them by NTT and the Japanese Government. Although manufactured products were the focus, the impacts spilled over into services, just as U.S. Government purchases of semiconductors and computers provided indirect aid for the software and telecommunications services industries here.

Attempts by European governments to build national champion firms have been less successful than in Japan. The European examples show the possible costs of sheltering domestic industries through procurement preferences. Favored firms may be less inclined to compete for international markets, and, as time passes, less able to do so—a problem that Japan has avoided in part through continued strong domestic competition, which has pushed Japanese firms to innovate rapidly and effectively.

Despite the partial exceptions of the information industries and construction, public procurement has seldom been turned to the direct promotion of service industries the way it has for, say, computer hardware. Thus an extension of the existing GATT Agreement on Government Procurement to cover services seems a reasonable prospect. This code, relatively weakly worded, currently exempts all services except those directly linked with purchases of goods. It also exempts preferential procurement policies that can be tied in some way to national security—a big loophole. Extending the Agreement to services irrespective of association with goods, and strengthening it generally, should help open service markets for many American firms. Of course, this would also open previously sheltered U.S. markets; thus the engineering and construction industry opposes such a step.

Regulatory Policies

Regulations as NTBs

When regulations function as quasi-NTBs, the difficulty for negotiators, legislators, and those charged with enforcing the rules is to separate legitimate uses from illegitimate. Some cases are obvious—rules that bar foreign-owned bank offices or subsidiaries (the practice until recently in Canada, Japan, and Australia). More subtly, governments may require foreign banks to maintain higher capital/loan ratios, or restrict access to clearinghouses or giro payments networks. The Tokyo Stock Exchange remained closed to foreign firms until 1985, when—after continuing pressure from the U.S. Government—four American companies were given seats. In professional services, licensing restrictions have often become quasi-NTBs. Table 50 gives further examples. Many of the NTBs listed have been in place for years—e.g., in ocean shipping. They can have major consequences for competitiveness, the more so if some countries maintain much tighter restrictions than others.

When regulatory regimes in industries like shipping remain stable over time, firms in various parts of the world eventually adjust to the competitive landscape. But shifts in regulations can have sudden and sharp consequences for international competition. In recent years, two events in the United States have upset the status quo: passage in 1978 of the International Banking Act, and the AT&T breakup 6 years later. The International Banking Act gives foreign banks relatively unrestricted access to the U.S. market (while placing their operations here under the U.S. regulatory system). The AT&T breakup likewise opened American markets to foreign suppliers of telecommunications equipment.

With domestic markets open, the U.S. Government has strong incentives to seek equal access abroad on behalf of American companies. Of course, the unilateral nature of U.S. actions has meant that foreign governments have little reason to go along unless the United States threatens to reverse course and close its markets once more—a threat embodied in some of the reciprocity legislation introduced in Congress over the past few years. Other countries have objected strenuously to the protectionist flavor of such measures, despite the fact that a number of regulatory bodies in the United States—including the Federal Communications Commission (FCC)—already apply reciprocity principles in decisions affecting international business.

Examples From Banking and Telecommunications

Regulatory regimes in financial services vary greatly among the industrial countries. Both France and Germany permit universal banking —i.e., they make no distinction between investment banking and commercial or retail banking. In the United States, Britain, and Japan,

Table 50.—Examples of Regulatory Barriers Affecting Services Trade and Investment

Banking:	
Canada	Foreign banks limited to no more than 16 percent of total banking system assets (8 percent until 1984)
Mexico	Market closed to foreign banks except through offshore banking facilities
India	Higher taxes on foreign banks
France	Domestic banks have access to subsidized loan funds
Insurance:	
Bolivia	Foreign insurance companies required to maintain much higher capital reserves
Australia	No new foreign entrants permitted (many other countries have similar restrictions)
Turkey	Some reinsurance must be placed with publicly owned company
Telecommunications:	
United States	No foreign ownership of basic telecommunications service providers
Japan	Foreign participation limited to joint ventures
Federal Republic of Germany	Public monopoly for all services
France	Public monopoly for all except information services
Engineering and construction:	
United Kingdom	Only British firms eligible for design contracts on North Sea oil projects
Venezuela	Foreign consultants must work through local firms
United States	Embassy construction abroad may be limited to U.S. firms
Shipping:	
United States	Jones Act restricts coastal shipping to U.S. carriers (many other countries have similar restrictions)
Airlines:	
Portugal	Government loan guarantees and other financial assistance (many other countries subsidize domestic air carriers)
United States	Government travel restricted to domestic carriers

SOURCES: Office of Technology Assessment, "Selected Problems Encountered by U.S. Service Industries in Trade in Services." Office of the United States Trade Representative, printout, Sept. 6, 1985.

more or less strict rules prohibit commercial banks from engaging in some forms of investment banking and brokerage activities. U.S. banks cannot participate directly in the financing of corporate stock or bond offerings; Japanese banks can hold ownership shares in corporations as part of their overall portfolios, but cannot act as brokers or trade in stocks.

As markets for financial services have become more internationalized, American banks and investment firms have pressed for relaxation of regulatory restrictions, particularly those that have not applied to their competitors overseas. Other countries, noting the deregulatory momentum in the United States, react with similar steps of their own—steps that in some cases will have major consequences for international competition. Certainly this is the case with liberalization of financial markets in Japan and elsewhere, as discussed in chapter 3. (See table 51 for recent changes in financial services regulations.)

Japanese corporations increasingly seek funds in international capital markets. Foreign companies have begun to seek capital in Japan or the Euroyen market. Greater competition inside Japan will result in aggressive moves by Japanese financial institutions abroad, with the yen becoming a more common international medium of exchange. Trading volume on the Tokyo Stock Exchange will continue to increase; indeed the Japanese stock market passed that of the United States in total capitalization in the spring of 1987. Meanwhile in London, the deregulatory "Big Bang" of October 1986 means new opportunities for British financial services firms at home, reducing their need to move overseas, but also creating new opportu-

Table 51.—National Treatment in Financial Services

Banking:	
United States	National treatment; some State laws may restrict entry
Japan	Substantial progress toward national treatment since 1979
Canada	Incremental shifts toward national treatment in 1980 and 1984; further changes proposed for 1987
Securities firms:	
United States	Federal law generally calls for national treatment and equality of competitive opportunity
Japan	National treatment generally followed; some movement toward full equality of competitive opportunity
Canada	Varies by province (Ontario prohibits entry into full service securities businesses, while Quebec, for instance, allows foreign firms to enter and operate on same terms as Canadian firms)
France	Entry and national treatment accorded with some exceptions (e.g., membership on the Paris Stock Exchange limited to firms with headquarters in the European Community)
United Kingdom	Major reforms in progress, with relatively open entry and national treatment expected under most circumstances

SOURCES: "National Treatment Study: Report to Congress on Foreign Government Treatment of U.S. Commercial Banking and Securities Organizations, 1986 Update," Department of the Treasury, Washington, DC, December 1986; "Report to Congress on Foreign Government Treatment of U.S. Commercial Banking Organizations, 1984 Update," Department of the Treasury, Washington, DC, 1984.

nities for foreign firms to enter the U.K. market; when the deregulatory schedule was announced, American financial services firms quickly began seeking mergers and acquisitions in Britain.

Despite greater integration in world financial markets, asymmetries in regulatory regimes will persist. Should the United States move toward universal banking, for instance, this would come about only after prolonged debate, or, more likely, continued piecemeal erosion of existing restrictions. Policymakers will have to weigh not only domestic concerns, but the impacts of regulatory change on the international competitive position of U.S.-based banks —a question seldom considered in the past, but now of considerable import. But the policymaking apparatus in the United States does not yet reflect the new importance of international competition in financial services.

Table 52 contrasts regulatory regimes for telecommunications in the five large industrial countries. In the United States, competition in long-distance services has been largely deregulated, although AT&T's rates remain under some controls as a result of the settlement agreement. With a shaky distinction between basic and enhanced services, and the seven regional holding companies (RHCs) formed after the breakup still precluded from offering the latter, the stage seems set for continued controversy. Policy guidance, after a fashion, continues to come through the offices of the FCC, the Department of Justice, and U.S. District Court Judge Harold Greene.

The German system provides the greatest contrast with deregulation here (see box N, ch. 5). In the Federal Republic, a single agency, the Bundespost, remains the monopoly provider of communications services, including mail and television. The other three countries offer closer parallels with the United States—as well as possible lessons. Japan's system, for example, shows the advantages of a clear separation between basic and enhanced services. Careful distinctions between Class 1 (basic) and Class 2 (enhanced services) carriers, and among types of value-added networks, have created a predictable environment: firms can calculate their interests and seek the appropriate licenses. Meanwhile, given uncertainties as to what the new rules in the United States will be, the RHCs have been scrambling for new markets and testing the bounds of the permissible. In France, even though most telephone and data services

Table 52.—Telecommunications Regulations Compared

	United States	Japan	France	United Kingdom	Federal Republic of Germany
Public monopoly	No	No	Yes	No	Yes
Geographic basis for regulation	Regional	National	National	National	National
Regulatory separation between basic and enhanced services?	Currently, yes	Yes	Yes	Limited	No
Competition in long-distance service?	Yes	Yes	No	Yes	No
Competition in value-added services?	Yes	Yes	Yes	Yes	Some

SOURCE: Office of Technology Assessment, 1987

remain under state control, competition in information services has been only lightly regulated. Judicious use of public funds to subsidize installation of Teletel/Minitel terminals spurred growth in the French market for enhanced services. Again, the lesson seems straightforward: regulations need not stifle innovation and market forces; competition flourishes when the rules are clear.

Standards

Government participation in determining product, technical, and professional standards has a dark side and a light side. Sometimes governments manipulate standards or professional licensing requirements to create NTBs; Japan's product standards have been a sore point with other governments for years.[16] In other cases, international agreements on technical standards can help create regional or world markets in place of fragmented national markets. Table 53 lists common NTBs in the services fostered by national standards and licensing requirements; many more examples could be cited.

Technical Standards

If national standards can act as NTBs, international standards can help to open markets—which does not mean that countries will be able to agree. Electrical outlets illustrate the problems. Hundreds of different designs for plugs and sockets exist around the world. Different countries use different voltages. National bodies for setting standards often exclude foreign firms. The result? Domestic appliance manufacturers typically have a slight cost advantage. After more than a dozen years, international discussions have ended with no progress toward agreement on a universal standard.[17]

Table 53.—Standards and Licensing Requirements That Can Serve as Nontariff Barriers

Sector	Possible barriers
Construction	Building and material standards
Telecommunications	Potentially differing ISDN systems, modem signal speeds, network protocols, incompatible system architectures
Financial services	Access to clearing systems (CHIPS and CHAPS, ch. 3) or giro payment systems
Law	Bar admissions; limitations on type of practice
Architecture, engineering	Licensing of foreign professionals

SOURCE: Office of Technology Assessment, 1987

Sometimes, of course, international standards do emerge: 1) in the absence of, or in spite of, the policies of governments; 2) because one or more governments adopt standards that become a clear choice for technical reasons; or 3) as a result of cooperation among governments and firms in international standard-setting bodies. Examples of the first case include the IBM PC as a de facto standard. While many companies independently bought large numbers of IBM PCs, the MAP (Manufacturing Automation Protocol) standard for linking factory automation equipment stems from the initiatives of a single major purchaser on the world market—General Motors (GM). MAP has now been accepted by several hundred other firms. Suppliers of both equipment and parts must go along if they expect to sell to GM. Prospective purchasers have adopted the standard because they know a great deal of MAP-compatible equipment will be available. None of this would have happened, of course, if MAP had not received wide acceptance as a reasonable choice on technical grounds. With the International Organization for Standarization (ISO) now involved, the eventual outcome may be a global standard.

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[16] See, for example, D. Christelow, "Japan's Intangible Barriers to Trade in Manufactures," *Federal Reserve Bank of New York Quarterly Review*, winter 1985-86, p. 11.

For the United States alone, the National Bureau of Standard's database now includes more than 30,000 voluntary technical standards. The Bureau also serves as a focal point for information and complaints on foreign standards.

[17] J. Callcott, "A World-Wide Plug Faces Disconnection After 74-Year Effort," *Wall Street Journal*, Apr. 1, 1982, p. 1.

National governments have sometimes acted unilaterally to establish standards for computer languages. Several international standards have come about largely because the U.S. Department of Defense first imposed them on military contractors—an example of the second case listed above. DoD now hopes that Ada will replace most of the 400 or so languages currently in use for defense systems.[18] In some contrast, the Japanese Government sought to make MSX a standard for operating systems in small home computers. While MSX had considerable success in Japan, it has not been accepted elsewhere. Currently, the West German Government is trying to establish a global standard for ISDN that will benefit the leading German equipment manufacturer, Siemens. To have much chance of success, the Federal Republic will have to convince other EC countries to go along. This may happen: the Society for Worldwide Interbank Financial Telecommunications (SWIFT) was able to set formatting standards and protocols for communications among member banks in part because a number of governments backed SWIFT rather than competing U.S. proposals. In doing so, they relaxed their own rules governing interfirm telecommunications services.

Individual companies and national industries can reap substantial benefits if they get their standards adopted internationally, but this usually takes a strong market position to begin with. As the MAP example illustrates, for others to accept a standard, they must perceive benefits for themselves. But given enough market power, big firms or the governments of powerful countries can sometimes establish standards that would not survive marketplace tests, or that are not at the technological frontier. Such an outcome can—like premature establishment of standards, or unduly restrictive technical specifications—foreclose desirable technological paths. These are real dangers, although often exaggerated by those opposed to standards for other (e.g., commercial) reasons.

Many international bodies provide forums for discussing standards. One of the oldest, the World Postal Union, originated in efforts to reduce incompatibilities in national mail systems. The International Telecommunication Union (ITU) grew out of the International Telegraph Union, founded in 1865. In addition to these more specialized bodies, committees within organizations like the OECD also provide forums for standards setting. The Tokyo Round GATT negotiations led to a new code (the Agreement on Technical Barriers to Trade) that counts as a small step toward making it more difficult for governments to use standards as NTBs.[19]

Perhaps the most important recent attempt to create an international standard began with a group of companies seeking an alternative to IBM's Systems Network Architecture (SNA) for linking computers. Their Open Systems Interconnection (OSI) alternative is important for two reasons: 1) network architecture and interconnection standards will be central to the design of the next generation of mainframe computers, and also to the telecommunications infrastructure (especially ISDN); and 2) many of the European participants have sought to define an OSI standard that would eliminate some of the advantages IBM now gets from its dominant position in the world market for large computer systems. General Motors' MAP standard is itself an OSI variant.

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[18] Probably a vain hope—see J. Jacky, "Ada's Troubled Debut," *The Sciences*, January 1987, p. 20. DoD spent something over $10 billion in 1985 for mission-related software, more than five times its hardware costs—E.J. Joyce, "SEI: The Software Battleground," *Datamation*, Sept. 15, 1986, p. 109.

[19] *International Competitiveness in Electronics*, op. cit., pp. 436-437.

After some 10 years of deliberation in forums including the ISO and the ITU's Consultative Committee for International Telephone and Telegraph (CCITT), the OSI standard gathered enough adherents that even IBM has begun to offer OSI-compatible equipment. The complex seven-layer specifications would arouse little controversy in the abstract, but on specifics the participating computer and telecommunications firms disagree; resolution of details inevitably works to the advantage of some, the disadvantages of others. Furthermore, some computer manufacturers—notably IBM—felt that they were being asked to supply proprietary information. IBM's reluctance to be too specific about its own systems encouraged the (perhaps not unrealistic) paranoia of other companies. In fact, the slowness with which IBM released technical details on SNA became a major factor in the ongoing dispute between IBM and the European Community, figuring in the settlement of the EC's antitrust suit against IBM.[20]

The stakes will be still higher for ISDN standards, with strong temptations for public telecommications authorities to implement ISDN in ways favoring domestic suppliers. The German Bundespost's efforts to help Siemens may simply be the first of many such attempts. As for OSI, the motives lie mostly in competition for hardware markets, not services. With competition in international markets for telecommunications equipment fierce, more companies are chasing business than can expect to survive. This strengthens the resolve of governments to help "their" firms, some of whom may not get a second chance if they lose out in early rounds of competition for ISDN sales.

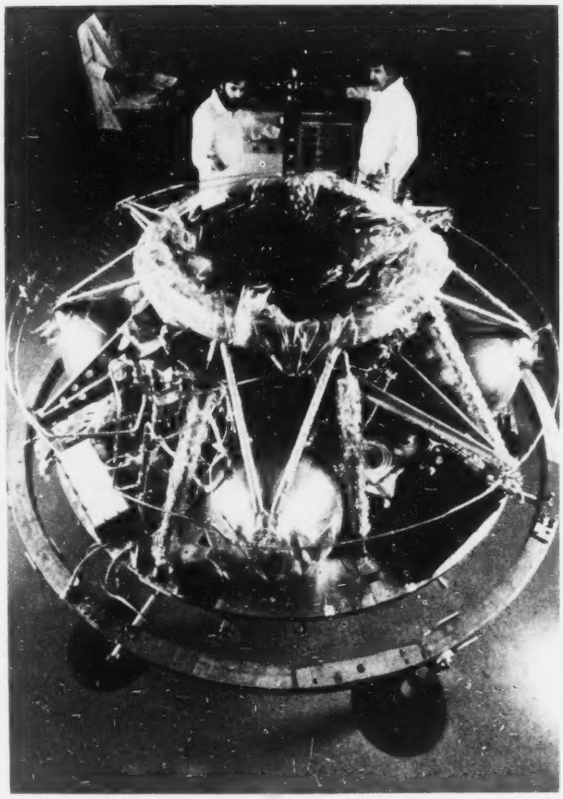

Photo credit: AT&T Bell Laboratories

Communications satellite under construction

Professional Licensing

While licensing standards for lawyers, engineers, architects, and other professionals may at first seem quite different from technical or product standards, they function in rather analogous fashion. On the one hand, they provide information for customers; on the other, they limit market entry and raise costs for those who wish to compete.

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[20] On OSI and its relationship to proprietary network architectures, see A. Meijer and P. Peeters, *Computer Network Architectures* (Rockville, MD: Computer Science Press, 1982) and *Future Information Technology—1984: Telecommunications* (Washington, DC: National Bureau of Standards, 1984), ch. 1. The seven layers range from connector designs at the physical interface (layer 1) to an application-specific layer (number 7).

The recently organized Corporation for Open Systems (COS), a nonprofit group of American and some foreign computer and telecommunications firms, represents the latest step in attempts to agree on networking standards. Although originally viewed as something of an anti-IBM coalition, IBM has now joined; with so many IBM computers in use, even that firm's biggest competitors felt they could not afford to leave IBM out of efforts to establish industry standards. See A. Pollack, "Computer Makers Seeking Standards," *New York Times*, Jan. 6, 1986, p. D4; "IBM Joins Group for Standards on Interconnection," *Electronic News*, Feb. 10, 1986, p. 16. The COS will support the OSI standard.

Professional licensing places a floor under expertise. Indeed, given the problems consumers face in evaluating the expected quality of service products such as medical care or legal advice, professional licensing has a vital role in the marketplace. But licensing can easily be turned to the creation of unfair entry barriers. It took 4 years of negotiations between the U.S. and Japanese Governments before Japan agreed to loosen its restrictions on foreign lawyers; because foreign-owned firms will not be allowed to hire Japanese attorneys or to give advice on Japanese laws, ample grounds for complaint remain.[21] Other professional services—e.g., accounting—provide similar examples of credentials and certification requirements serving as NTBs; many countries, for instance, routinely deny visas to professionals who do not hold locally valid credentials.

Intellectual Property Protection

Counterfeiting—of clothing, auto parts, pharmaceuticals, personal computers with false or misleading brand names and trade marks—has become a big business.[22] So has illegal copying of books, audio recordings, movies, videotapes, and computer software. In many countries, weak laws and lax enforcement mean that none of the usual instruments—patents, copyrights, trademarks—provide much protection for intellectual property rights. With most of the counterfeiting and copying taking place in LDCs and NICs, the industrialized countries have a common interest in seeking stronger protection. Most of the problems in services arise in information-related products—audio and videotapes, databases, computer software.

Pirating of books has been a major industry in countries like Singapore for years; it is no surprise to see the pirates moving on to software. But why has intellectual property protection become a new issue in the Uruguay Round? In part because of new technology, as explained in box GG. As long as most computer programs ran on expensive machines, illegal copying remained a minor problem. With low-cost PCs opening a mass market, counterfeiters not only sell fakes that resemble IBM and Apple hardware, they also copy and sell software for these machines. Illegal copying by individual users has also been widespread. With no technical means for reliably preventing copying likely to emerge, the problem remains one for the legal system (or the market).

Services supplied over the telecommunications infrastructure raise similar issues. An online database—consisting, say, of news stories —might not at first sight appear too different from the print media on which it draws. But it is, largely because the database, like fourth-generation software, has a form that is fluid rather than fixed. Copyrights were intended for works like books, musical compositions, and motion pictures; how can information be registered and protected when the database changes every day?

Meanwhile, as pointed out in box GG, some developing countries, and a few in the industrialized world, have considered or taken steps to relax, rather than strengthen, intellectual property rights. Weak forms of copyright/patent protection have been proposed in Mexico, Brazil, and Japan. The motives are straightforward: to make it easier for domestic firms to take advantage of foreign technology. While the Japanese copyright proposal for software was

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[21] The new regulations will be enforced by Japan's Department of Justice. See "Foreign Attorneys' Practice in Japan, Other Services Issues Focus of Chicago Conference," *International Trade Reporter*, Feb. 12, 1986. Also, T. Lewin, "Lawyers Await Japanese Rules," *New York Times*, July 29, 1986, p. D2.

[22] While estimates for U.S. sales of counterfeit goods, almost all imported, run well into the tens of billions of dollars, there is little agreement on the actual size of the counterfeit goods market. See A.M. De Stefano, "Customs Agents Fight Often-Losing Battle Against Illegal Imports: Up to $40 Billion of Fakes, Contraband Enter Yearly, Some Experts Estimate," *Wall Street Journal*, Jan. 28, 1986, p. 1; and B. Stokes, "Intellectual Piracy Captures the Attention of the President and Congress," *National Journal*, Feb. 22, 1986, p. 443. On efforts to control illegal imports, see *U.S. Firms' Views on Customs' Protection of Intellectual Property Rights*, GAO/NSIAD-86-96 (Washington, DC: U.S. General Accounting Office, May 1986); and D. Hebditch, "Pirate's Paradise," *Datamation*, Sept. 1, 1986, p. 71. On the general problem, see *Intellectual Property Rights in an Age of Electronics and Information* (Washington, DC: Office of Technology Assessment, April 1986).

The major offenders, according to most accounts, include Singapore, Taiwan, Indonesia, South Korea, the Philippines, Malaysia, Thailand, Brazil, Egypt, and Nigeria—C.H. Farnsworth, "U.S. Plans To Defend Its Patents," *New York Times*, Apr. 7, 1986, p. D1.

Box GG.—Protecting Intellectual Property

In general, intellectual property can be protected as: 1) a work of art (motion pictures); 2) a work of fact (encyclopedias, computerized databases); or 3) a work of function (inventions, technological know-how).[1] Patents, not copyrights, have traditionally protected works of function.

Systems of Intellectual Property Protection

As pointed out in chapter 6, there is no such thing as an internationally valid patent, trademark, or copyright: each nation administers its own system. In many countries, copyright and patent laws have evolved side by side with international agreements like the Berne Convention for the Protection of Literary and Artistic Works, the Universal Copyright Convention, and the Paris Convention. While the United States has never joined the Berne Convention, it is one of 96 members of the Paris Convention, the oldest international treaty on patents, trademarks, and unfair competition.

Legal protections for intellectual property tend to be similar among the industrialized nations; American businesses have become familiar with them, feel able to work with or around them, and generally believe them adequate. It is in the LDCs and NICs that lack of effective intellectual property protection has led to competitive difficulties for U.S.-based firms. Some countries rationalize weak protection for intellectual property in the name of low costs for consumers. It seems clear, however, that policies in many of the LDCs have been structured to help local firms acquire foreign technologies as quickly and cheaply as possible. Indeed, developing countries—primarily the Group of 77—have been seeking *reduced* levels of intellectual property protection in several multilateral forums, claiming that this is justified to redress the imbalances they perceive between technology haves and have-nots.[2] Many LDCs question the view that private ownership of technical knowledge leads to efficiency in economic development processes; they feel that protection for intellectual property hurts them while benefiting foreign-based MNCs.

Intellectual Property as a Trade Issue

In the past, intellectual property rights have seldom been viewed as trade-related matters like tariffs or subsidies. This has changed over the last few years, as complaints over counterfeiting and piracy have escalated. In the United States, the issue has caught the attention of the Economic Policy Council in the Cabinet, as well as Congress. The Trade and Tariff Act of 1984 makes protection for U.S. intellectual property rights a factor in decisions on renewal of agreements under the Generalized System of Preferences. Among bills in the 100th Congress, both H.R. 3 and S. 490 address the international dimensions of intellectual property rights. Moreover, the Semiconductor Chip Protection Act passed in 1984 extends protection to foreign parties only if their home country makes good-faith efforts to reciprocate.

National treatment has been common in intellectual property protection—meaning that foreign parties are to be on the same footing as residents. In fact, overt discrimination has never been common; one result of national treatment is to help perpetuate the uneven levels of protection that have existed. At the moment, then, perhaps the greatest need is for harmonization in intellectual property protection—not an easy task given the unwillingness of some countries to control copying and counterfeiting. Some do not subscribe to international regimes; others ignore them. In part because of disillusionment with WIPO and UNCTAD, the United States and other developed nations have turned to GATT in search of relief—a step that developing countries have resisted, arguing that intellectual property issues belong exclusively in WIPO

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[1] See *Intellectual Property Rights in an Age of Electronics and Information* (Washington, DC: Office of Technology Assessment, April 1986), pp. 65-88. The rising number of cases brought before the U.S. International Trade Commission, rather than patent courts and other specialized tribunals, illustrates the increasingly political nature of trade-related conflicts over intellectual property rights.

[2] Within the World Intellectual Property Organization (WIPO), a United Nations body that now administers the Paris Convention, the LDCs have proposed compulsory licensing and patent forfeiture requirements. The Code of Conduct on the Transfer of Technology prepared by the United Nations Conference on Trade and Development (UNCTAD) would forbid business practices such as restrictions on exporting by licensees. See *Preserving America's Industrial Competitiveness: A Special Report on The Protection of Intellectual Property Rights* (Washington, DC: President's Commission on Industrial Competitiveness, 1984), pp. 35-37.

While multilateral forums like WIPO do provide a venue for discussion, such bodies are unlikely to take meaningful action. Given problems of some urgency in fast-moving industries like software and information services, U.S. negotiators will need to involve WIPO but cannot depend on it for progress. Bilateral negotiations will probably prove more fruitful, at least in the short run. Indeed, in the case of South Korea, they already have. After extended negotiations, Korean officials agreed to implement stronger patent and copyright protections.[3] Progress bilaterally can help lay groundwork for more comprehensive multilateral agreements, in GATT or elsewhere. But protection for software poses still knottier problems, because traditional mechanisms have proven inadequate for technical reasons.

Computer Software

None of the familiar categories of intellectual property protection fit software comfortably; because computer programs have high development costs but low production costs, and can be easily duplicated, unauthorized copying is common—particularly for the standardized programs that run on small machines. Piracy and counterfeiting have become a major concern for U.S. software producers, both at home and abroad; ADAPSO, the trade association of computer software and services firms, claims that unauthorized copying cost the American industry $800 million in lost revenues in 1985. At present, American software companies lead the world; without better control over illegal copying, their future competitiveness could be harmed. The special problems of protecting software—and its significance—make this something of a test case for the evolution of the intellectual property protection system.

Of the two routes to protection, technical means—supplying programs in such a form as to make copying impractical or impossible—have consistently proved ineffective. Software pirates quickly find ways around new protective schemes, no matter how ingenious, just as car thieves manage to keep stealing automobiles; indeed, a copy-protection defeating industry exists.[4] Moreover, corporate customers have tended to oppose the technical schemes because of their inconvenience. Legal means, the second route to protection, seem to offer the only hope of a practical solution. The problem is that neither the laws governing patents and copyrights, nor the administrative procedures for enforcement, were designed with products like software in mind.

In effect, software falls between the stools of patent and copyright law. Of the three types of intellectual property—works of art, fact, or function—computer programs would be classed most naturally as works of function. However, they do not fit this class in a legal sense, generally failing tests based on prior art and tangible physical form. U.S. courts have held that patents can only be granted for programs that implement physical operations—e.g., running a typesetting machine or a numerically controlled machine tool. Although many such applications exist, and patenting of programs has been rising, such applications account for only a tiny fraction of all software.

Patents, where granted, protect the functional aspects of the program—what it does, rather than the code that implements the program's functions. Under U.S. law, software can be protected through copyright as a form of writing or work of art; but in this case the copyright protects the written or coded program, not its function or its logical structure. Because the same functions can be coded in many ways—indeed, there may be an almost infinite set of program codings (and logical structures) that will yield a functionally equivalent software package—protecting only the code accomplishes little. With effort, others can duplicate what the program does without duplicating the coding.

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[3] S.B. Butler, "US and S. Korea Resolve Trade Disputes," *Financial Times*, July 22, 1986, p. 6. Under previous Korean laws, for example, chemical and pharmaceutical products could not be patented. Also see "U.S. Plans To Defend Its Patents," *New York Times*, April 7, 1986, p. D1.

[4] See, for example, J. Taylor, "The Copy Protection Wars," *PC Magazine*, Jan. 14, 1986, p. 165; also P.B. Gray, "A Software-Lock Breaker Becomes A Hero to Some, a Villain to Others," *Wall Street Journal*, Feb. 27, 1986, p. 23. On user opposition, see V. McClellan, "Padlock Copy Protection: End of an Era," *Digital Review*, Sept. 1, 1986, p. 64.

Gradually, then, legal decisions have been accumulating that extend copyright protection to the functions available to users. Currently, an infringement suit can be brought if someone else's software closely resembles, from the user's viewpoint, the copyrighted product.[5] This is a limited step, in part because software is evolving in the direction of programs that users can modify to suit individual requirements (fourth-generation languages, ch. 5). If customers can define or change the function of purchased software, will it be possible to protect the functional features? At present, there seems no easy way out of such dilemmas; in any event, copyright law in much of the rest of the world has hardly begun to confront them.

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[5] E. Lach, "Court Backs 'Look & Feel' Copyright," *Infoworld*, Oct. 20, 1986, p. 1; W.M. Bulkeley, "Courts Expand the Copyright Protection of Software, but Many Questions Remain," *Wall Street Journal*, Nov. 18, 1986, p. 35; D. Stipp, "Lotus Suit Charges Two Software Firms Infringe on 1-2-3 Program Copyrights," *Wall Street Journal*, Jan. 13, 1987, p. 8.

ultimately defeated because of protests from domestic as well as foreign software suppliers, the Mexican and Brazilian laws still stand.

On the other hand, recent concessions by South Korea—a notorious offender—show that progress is possible (see box GG). The agreement, which took several years to negotiate, also suggests the dimensions of the problem. Bilateral negotiations are expensive and time-consuming. A dozen other countries have been equally blatant offenders. Dealing with them on a case-by-case basis, rather than in multilateral forums, puts considerable strain on the responsible U.S. agencies. And, in countries where governments have tolerated piracy and illegal copying for years, enforcement may be more important than the letter of the law.

INTERNATIONAL NEGOTIATIONS

The United States has many competitive strengths in the services, starting with an unmatched base in information technologies. The first step in maintaining the Nation's competitive position is simply to continue the policies that have helped foster past growth—policies that range from promotion of competition through vigorous antitrust enforcement to support for research in technology and science. In an increasingly interdependent world economy, however, domestic measures will not by themselves suffice. Nor will trade negotiations within GATT, no matter how successful. Negotiations in other forums will also be needed.

Reasons for pursuing issues related to the services in forums outside GATT begin with the need to improve GATT discipline over trade in goods. Pushing too hard for a services agreement might endanger progress on the goods track. Despite attempts to separate them, and despite the two-track agenda for the Uruguay Round, goods and services will remain linked in the eyes of many countries. When it comes to the services, it is possible that negotiations will move beyond general questions to sector-specific issues. If they do, some nations will seek concessions on goods trade in exchange for concessions on services.

In any case, a GATT umbrella agreement on services should make progress easier in other multilateral forums and in bilateral talks (where the U.S.-Israel Declaration on Trade in Services may also provide a model for future agreements). Although the choice of forums for supplementary discussions will itself become a matter for negotiation among governments—and among agencies within the U.S. Government—there are a priori reasons for suggesting that GATT and the OECD will remain the appropriate places for issues of trade and investment flows, that specialized bodies like the CCITT offer the best prospects for agreements on technical standards, that export subsidies and mixed credits are a matter for the OECD, and so on.

GATT and the Uruguay Round; Other Forums

While the United States has laid solid groundwork for discussions on the entire range of new issues within GATT, resistance on the part of developing countries will continue as the Uruguay Round unfolds. Few of these countries have developed more than a vague sense of their interests; the strong stand of the United States, and now Japan and the EC, heightens suspicion that concessions on services and other new issues will be to the disadvantage of the Third World. As developing countries focus on the substance of the negotiations, analyzing the potential benefits of liberalization, some of their suspicions will be dispelled. But if pragmatism will overcome some objections, it will not be enough when these objections have roots in ongoing strategies for economic development. LDCs and NICs will continue looking to import substitution and export-led growth as paths to industrialization and an improved position in the world economy; they will continue to resist efforts to lower barriers that shelter firms and industries they regard as vital for development.

Given continuing Third World opposition—some of it stemming from desire to slow the inroads of Western cultures, some from traditional reliance on regulatory practices that create quasi-NTBs, some from long-held development objectives—the United States and the other industrial countries may have to turn to forums that do not require the consent of developing countries. When it comes to narrower questions, bodies outside GATT not only have a well-established place but may offer better prospects for reaching agreement. Table 54 gives a possible schema for matching issues and forums. The OECD, for example, could provide something of a parallel to GATT for the more general issues; indeed, several OECD codes are being revised to integrate services more fully. Moving ahead in the OECD (or bilaterally) while the Uruguay Round is in progress risks resentment in developing countries if they feel unable to influence the new regimes being negotiated; even so, this could be a prod to substantive negotiations within GATT.

Moreover, bilateral negotiations on services-related issues between the United States and such major trading partners as Japan, Canada, and the members of the EC will be needed no matter the progress in GATT. There can be no simple formulas for such talks. Rubrics like national treatment and reciprocity put forth in the past have not proved very useful in finding common ground for resolving long-lasting conflicts; nor have these general principles proven of much value in defending U.S. interests in specific cases. Nonetheless, greater harmonization of policies affecting services will clearly remain a primary aim of U.S. negotiators.

Toward a Better Linkage of Foreign and Domestic Policy

When it comes to negotiating with other governments, the United States must live with a real disadvantage: the lack of a coherent institutional structure for arriving at bargaining positions and determining who will do the negotiating—a longstanding and much-noted aspect of U.S. trade policy. Talks on services will bring new complications where they touch on matters under the jurisdictions of regulatory agencies that have usually been well-removed from international deliberations and international responsibilities.

The Office of the United States Trade Representative (USTR) shares the responsibility of preparing for trade talks with the Department of Commerce, as well as the Departments of State and Treasury. A panoply of agencies—the Federal Reserve Board, FCC, Department of Justice, Federal Trade Commission, among many others—play a role in domestic decisions that have direct or indirect impacts on the international competitiveness of U.S. industries, and, potentially, on U.S. negotiating positions. Some of these agencies have responsibilities that extend to international matters; others have largely domestic horizons. In the absence of careful White House scrutiny, and continuing supervision, U.S. policies can easily become incoherent and stay that way.

Table 54.—Examples of Issues and Forums Relevant to the Services

	GATT	OECD	Other
Trade barriers	✓		United Nations Council on Trade and Development (UNCTAD)
Investment barriers	Trade-related	✓	Economic summits; United Nations Commission on Transnational Corporations (UNCTC)
Transborder data flow restrictions	✓	✓	UNCTC
Government procurement regulations	✓	✓	
Export credits	✓	✓	UNCTAD
Intellectual property	✓	✓	WIPO[a]
Technical standards	✓	✓	International Organization for Standardization (ISO); ITU (including CCITT and WATTC)[a b]

KEY: GATT = General Agreement on Tariffs and Trade;
OECD = Organization for Economic Cooperation and Development;
WIPO = World Intellectual Property Organization;
ITU = International Telecommunication Union.

[a] Now affiliated with the United Nations

[b] The CCITT (Consultative Committee for International Telephone and Telegraph), a permanent ITU body, makes recommendations on technical standards. The WATTC (World Administrative Telephone and Telegraph Conference) meets on occasion to consider changes in ITU regulations.

SOURCE: Office of Technology Assessment, 1987

The need to develop and present a consistent U.S. position will become, if anything, more pressing if the Uruguay Round moves on to sector-specific deliberations—e.g., for services like telecommunications, where other forums have established and ongoing roles. Thus the U.S. position at upcoming ITU meetings (table 54) will need to be closely coordinated with any sector-specific discussions on telecommunications that might be underway in GATT. The ITU has scheduled a plenary session of the CCITT during 1988, along with a World Administrative Telephone and Telegraph Conference (WATTC) meeting—the first since the early 1970s. These will be followed by a plenipotentiary meeting of the ITU in 1989. When it comes to the ITU, the State Department has the job of developing and presenting the U.S. position —with substantive policy input from other agencies, and extensive consultation with the private sector. This task has become much more difficult with the breakup of AT&T. Not only do several Federal agencies need to be involved —State, the FCC, USTR, Commerce's National Telecommunications and Information Administration—but literally hundreds of U.S. firms now have a stake in ITU decisions.

It has become trite for reports like this to suggest remedies such as more effective coordination by the Executive Office of the President or consolidations of existing agencies (e.g., a department of international trade and industry). Nevertheless, even those who regard such proposals as unrealistic must admit that the problems are real ones, and sometimes have serious consequences for U.S. foreign economic policy. Services, as a new issue on the national agenda, may offer an opportunity for Congress and the executive branch to consider a somewhat less chaotic set of arrangements—a question to which the next chapter returns.

CONCLUDING REMARKS

The United States comes to the new GATT round in an impressive position. The international competitiveness of American service firms remains generally high; the size of the U.S. market makes the threat of restrictions on foreign access a powerful negotiating weapon.

But the Uruguay Round also poses a major challenge for U.S. leadership. As the United States continues to impose ad hoc restrictions on imports of goods, gaps between action and rhetoric become harder to paper over. Developing countries will not be likely to accept liberalization of services trade accompanied by continued closing of markets for the labor-intensive goods they must export in order to grow and to service their debt. Nor does the United States, today, necessarily have the economic muscle to get its way.

The background prospect of a surge of protectionist sentiment in the United States, or reciprocity legislation, may deter some of the more objectionable forms of protectionism in other countries, and help bring them to the bargaining table. But given the nature of the problems afflicting the international trading system, more may be needed than bargaining as usual. When it comes to intellectual property rights, for example, the United States has been successful with South Korea, as well as in getting the issue onto the Uruguay Round agenda. Meanwhile, various bills have been proposed to penalize countries that fail to recognize the rights of U.S.-based firms. Some bills would set time limits for negotiations with offending countries; if an acceptable agreement could not be worked out, the President would be expected to apply countermeasures of one sort or another. Others would prescribe specific negotiating objectives. But the greater need seems to be for a U.S. strategy aimed at establishing a new regime for intellectual property protection—one better suited to current and emerging technologies. Developing such a strategy might take a good deal of analysis and planning before negotiations began.

International technical standards provide another sort of illustration of the shortcomings in the U.S. approach to foreign economic policy. This country does not always have a good grasp of what is at stake when it comes to such questions. To many people, the standard-setting process seems opaque, the technical questions a mystery. Many of the firm-specific or country-specific interests remain hidden. International negotiating forums are slow-moving and perplexing, if not byzantine.

It is certainly true that those who set broad policy goals will seldom need to concern themselves with the details of standards; still, in the United States, the policymaking community has perhaps underestimated their significance for international competition, particularly with tariff barriers largely down and NTBs taking their place. Although the subject is esoteric compared to quotas for steel or subsidies for agricultural products, conflicts over OSI standards have already done real if minor damage to U.S.-European relations.

The point is a more general one: leaving aside national defense, the U.S. policymaking community seldom shows much interest in or understanding of technical matters. Finding new ways of protecting intellectual property rights inevitably raises questions that demand some appreciation of the technologies involved in, say, fourth-generation computer languages. So does grasping the stakes involved in negotiations over ISDN standards.

The possibilities for U.S.-European and U.S.-Japanese cooperation on R&D related to communications and information technologies (or further cooperation in space) provide a further example of the increasingly technical character of matters that, most fundamentally, remain in the realm of foreign policy or international economic policy. Cooperation might help reduce tensions among the major industrial countries, as well as unnecessary duplication in research. Cooperation on, say, R&D or demonstration projects for ISDN would be easier to arrange (and probably more productive) if limited to industrialized nations. But participation by Third World countries could help reduce the suspicion that initiatives aimed at liberalizing services and high-technology trade would necessarily work to their detriment. Including developing countries in multinational development projects could become an incentive for cooperation on other fronts. The Third World has strong interests in not being relegated to the margins of technology trade; these interests create opportunities for liberalizing the world trade regime (as well as impediments). The United States, however, has had little experience in developing such programs, or in managing them so they function effectively.

Fundamental conflicts of interest, as well as lagging understanding by some countries of what they might gain, slowed the process of laying groundwork for the new MTN round. The talks themselves promise to be the most difficult in GATT's 40-year history. USTR has been at the center of U.S. efforts to pursue services liberalization since the beginning. The agency will be stretched for resources as the Uruguay Round proceeds, and as services issues proliferate in other forums and bilaterally.

With international negotiations dealing with specific sectors arising alongside those on broader principles, USTR will have to rely on staff work by other agencies. These agencies, in order to provide effective support, will have to quickly come up to speed as specialized problems surface. U.S. representatives will have to be flexible in their choice of forums—and in coordination of negotiations—and careful to appreciate the underlying development strategies of other countries. Advisory processes will probably need restructuring. At present, USTR works with 14 Industry Sector Advisory Committees (ISACs) representing manufacturing industries, but only two groups drawn from the services. The farther negotiations move beyond general principles to sector-specific issues, the greater will be the need for new ISACs to speak for service industries and their employees. The next chapter discusses both resources for USTR, and advisory mechanisms, in more detail.

Among U.S. handicaps as the new round begins, two deeply rooted attributes of the Nation's policymaking system stand out: 1) reliance by the Federal Government on military spending, almost exclusively, to stimulate technological development; and 2) dispersed decisionmaking authority when it comes to regulatory and trade policies. GATT has been successful in reducing tariff levels, somewhat less so in controlling other direct barriers to trade (e.g., quotas). Meanwhile, countries around the world have been turning to indirect and less visible policy instruments: subsidies, discriminatory regulations, the entire array of tools associated with national industrial policies. Certainly, U.S. negotiators have had success in dealing with some of the indirect barriers—e.g., convincing the Japanese to let in foreign lawyers. But in a more general sense, the United States finds itself increasingly unable to respond. We have no tradition of explicit industrial policy, thus cannot credibly threaten to provide concerted support for U.S. firms internationally; other countries know that any policy extending such support would be subject to reversal on short notice. At a minimum, achieving U.S. goals on services and other new issues in the Uruguay Round will demand careful attention to the management of jurisdictional overlaps within the Federal Government, particularly where domestic regulatory policies and foreign economic policy come together. Beyond this, the many Federal agencies whose policies affect the competitive ability of U.S.-based service firms—either directly or as side-effects of domestic regulatory policies—will need to take greater account of these impacts in the future, a point stressed in the next chapter.

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U.S. Government Policies: Issues and Options

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Chapter 10

U.S. Government Policies: Issues and Options

SUMMARY

International competitiveness has domestic roots: the ability of an American firm in any industry to compete with foreign rivals depends on its costs of production, on the design of its products, on its marketing skills—in short, on its ability to provide customers with what they want, at a price they're willing to pay. No U.S. trade or foreign economic policy can in itself reverse the fortunes of an industrial sector that has lost, in a fundamental sense, the ability to compete internationally. Domestic policies of the U.S. Government might (or might not) be able to help such an industry rebuild its competitiveness. Trade policy might be able to equalize the terms of competition between U.S. and foreign firms. The same logic holds for an American industry at the top of the international competitive ranking: Federal policies cannot ensure that the sector will remain on top, although they can support the industry's own efforts. The implication: when it comes to international competitiveness, the first condition for effective policymaking is an appreciation of what government can expect to accomplish and what it cannot. The second condition is an appreciation for the ways (often subtle and indirect), and the time scales (often long), in which domestically directed policies—whether dealing with regulation of banking, with support for technology development, with education and training—affect the international competitive ability of American firms.

Such is the context for the discussion in this chapter of government policies that affect the competitiveness of the Nation's service industries. The chapter covers 33 policy alternatives. Much of the discussion reflects the "new issues" character of trade and competition in the services. Governments are just beginning to grapple with the implications for international trade and competition of economies heavily tilted toward the services. While the United States is further along than most, here too the process of articulating goals and implementing policies remains in its early stages. Efforts by business interests to get services trade onto the Nation's policy agenda began in earnest in the 1970s. By 1982, the U.S. Trade Representative (USTR) was seeking a place for services in a proposed new MTN round (multilateral trade negotiations, ch. 9). Congress, in its 1984 trade bill, gave USTR responsibility for coordinating the development of trade policy for the services, and charged the Department of Commerce with devising a service industries development program. Meeting in Uruguay in September 1986, members of the General Agreement on Tariffs and Trade (GATT) agreed to begin a new trade round including discussion of services.

The Uruguay Round negotiations promise to be lengthy and difficult. The concessions the United States can realistically ask of other nations, and those it can offer in return, will depend to considerable extent on domestic regulatory structures. But while trade negotiators must remain keenly aware of the constraints and opportunities presented by domestic policies, the linkage has been mostly one-way: considerations of international trade and competition have seldom had much influence on domestic policymaking. The policymaking apparatus stems from an era when trade and domestic policies could be kept separate and distinct. Even in the 1950s and 1960s, the impacts of Federal policies rarely extended beyond the domestic economy. This is no longer true, but policymaking processes seldom reflect the new realities—and far less for service industries than for manufacturing (because services trade is not only smaller but less visible). The central message of this chapter can then be summarized as follows:

- American service industries must compete in a world of increasingly potent rivals.
- Federal Government policies traditionally

viewed as domestic affect the ability of American firms to compete internationally.

- Policymakers—including those in regulatory agencies—need to consider, as a matter of course, the impacts of their decisions on international trade and competition.
- This new and broader view will be more vital for the services than for manufacturing because government policies have greater influence over competitiveness in the service industries, many of which are regulated.

If the needed changes come too late, U.S. international competitiveness in the services will probably slip. If competitiveness in the services slips as much as it has in manufacturing, the Nation's living standards will be further endangered.

Although the new competitive realities for American industry have been apparent since the 1970s, Federal agencies by and large continue to slight the international impacts of domestic policies. Today, policy issues—be they matters of R&D support for industries like engineering and construction (E&C), the role of the Federal Communications Commission (FCC) as the telecommunications industry continues to restructure, or restrictions on interstate banking—must be seen in a new context. This context—one in which U.S. industries are immersed in a global economy, sometimes competing with foreign firms, sometimes cooperating with them—means that domestic and foreign economic policies can no longer be viewed independently. Because the changes are so fundamental, *it may be time for Congress to seriously consider equally fundamental shifts in the structure of the Nation's policymaking apparatus.* While changes in structure (for instance, the establishment of a cabinet-level department of trade) are no substitute for good policy, they could give policymakers the tools needed to implement well-conceived policies—tools that, judging by results, they do not currently seem to have.

OVERVIEW OF POLICY OPTIONS

Beginning with trade issues, the discussion in this chapter turns to linkages between domestic policies and international competitiveness, to human resources, and to technology development, before returning to the policymaking process itself. This section outlines the main themes, with selective references to the policy options listed in table 55. This first table identifies the issues and options covered in the chapter, listing each by number. Tables 56, 57, and 59-61, which follow later, summarize the options. Appendix 10A, at the end of the chapter, outlines a few of the many ways in which tax policy can affect competitiveness in the services.

With major trade bills (H.R. 3 and S. 490) quickly introduced in both House and Senate, a new record current account deficit in 1986 (some $141 billion), and a new GATT round beginning, there is every reason to expect that trade will remain in the spotlight during the 100th Congress. The Administration, as well, may be ready to assign competitiveness a higher priority.[1] Two overriding concerns will continue to shape the debate: 1) how to manage the strains that rapid competitive shifts have forced on the U.S. economy; and 2) how to continue working toward a more open international economic system. These two broad objectives inevitably come into conflict.

A trade policy that the public understands and accepts must be based on a shared view of U.S. interests. The question policymakers constantly face from domestic constituents and interest groups is this: How, specifically, does the United States benefit from continued liberalization of the world trading system? Good answers depend on an understanding of the

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[1] President Reagan's competitiveness package is the proposed Trade, Employment, and Productivity Act of 1987, H.R. 1154 and S. 539.

Table 55.—Summary Guide to Policy Options[a]

Issue Area	Option	Relevant service sector
I. The Services and U.S. Trade Policy *(see table 56, p. 336; for details)*		
A. NEGOTIATING OBJECTIVES		
—Congressional guidance	1	all
B. COORDINATION OF SERVICES POLICY		
—Oversight on coordination of trade negotiations	2	all
C. TRADE ANALYSIS AND DATA		
—Long-term analysis for trade policy and planning	3	all
—Oversight on collection of services trade data (also see Option 12)	4	all
—Improving the data on trade in services and on technical licensing	5	all; licensing
D. SUPPORT FOR THE NEGOTIATIONS PROCESS		
—Staff and budget for USTR and other agencies	6	all
—Service sector advisory committees (also see Option 16)	7	all
—Continuing evaluation of U.S. and foreign regulations that act as non-tariff barriers	8	all
E. OTHER TRADE-RELATED ISSUES (see table 57, p. 345)		
—Overseas promotion of exports	9	primarily E&C
—Tied aid and mixed credits	10	primarily E&C
—Trade and Development Program (TDP)	11	primarily E&C
II. Linkages between Domestic Policies and International Competitiveness *(table 59, p. 349)*		
A. EXAMPLES FROM BANKING AND FINANCIAL SERVICES		
—Data on international trade in banking	12	banking
—Office on international impacts of banking policies	13	banking
—International coordination of regulations	14	banking
B. EXAMPLES FROM TELECOMMUNICATIONS		
—Negotiating objectives	15	telecommunications;
—Advisory committee on telecommunications negotiations	16	telecommunications
—Institutional mechanisms for addressing impacts of domestic policies on competitiveness	17	telecommunications
III. Human Resources *(table 60, p. 357)*		
A. EVALUATION		
—Fundamental reexamination of human resources policies as they affect competitiveness	18	all
B. ADULT EDUCATION AND TRAINING		
—Demonstration projects for training/retraining of the active work force	19	all
—Increasing the national commitment to education and training of active workers	20	all
—Postsecondary vocational/technical curricula	21	all
C. INSTRUCTIONAL TECHNOLOGY		
—Inventory of federally developed training materials	22	potentially all
—Transfer of federally developed training methods, procedures, and course materials	23	potentially all
—Funding for research, development, evaluation, and dissemination of instructional technologies	24	all
IV. Technology Development *(table 61, p. 362)*		
A. R&D IN THE SERVICES		
—Improving Federal Government data	25	all
B. THE U.S. TECHNOLOGY BASE		
—Federal support for commercial R&D	26	all, E&C
—Technology diffusion to industry	27	all
—Implementation of Japanese Technical Literature Act	28	all
—International exchanges of technical personnel	29	all
—Equitable access to foreign technology	30	all
—Analysis of impacts of defense-related R&D on U.S. competitiveness	31	all
C. TECHNICAL STANDARDS		
—Federal testing and demonstration facility for ISDN	32	information and telecommunications; indirectly all
—Preparation for upcoming meetings of the International Telecommunication Union	33	information and telecommunications; indirectly all

[a] This table appeared in ch. 1 as table 2.

SOURCE: Office of Technology Assessment, 1987.

sector-specific strengths and weaknesses of the Nation's economy. This will be as true when it comes to liberalization of trade and investment in the services as it has been for goods trade. OTA's analysis in earlier chapters shows many U.S. service industries to be highly competitive internationally. It is the case that the E&C industry has been losing ground since the 1970s, while sectors like banking face strong competition. But considering the services as a whole, liberalization of trade and investment should help maintain U.S. advantages.

To get agreements in the services, however, the United States will probably have to make concessions elsewhere: discussion of services in the new round will not take place in a vacuum. With GATT discipline over trade in goods breaking down, crafting the U.S. position may prove tricky. Along with other industrialized nations, the United States has restricted imports of goods ranging from steel to textiles, automobiles to television sets. Some of these restrictions plainly meet GATT tests; others have evaded the spirit if not the letter of the rules. As pointed out in the preceding chapter, much of the opposition to services negotiations in the new round has arisen among developing nations that have found access for their exports of merchandise closing down. Despite the two-track nature of the Uruguay Round, the Third World will certainly ask that the industrial countries take more of their goods in return for liberalization in services.

On such questions concerning the place of the services in U.S. trade policy, OTA discusses eight policy options (table 55), beginning with negotiating strategy in the Uruguay Round. While Congress traditionally gives the executive branch considerable flexibility in conducting such negotiations, congressional guidance, formal or informal, will be needed if the Administration is to bring back a politically acceptable agreement (Option 1). Congress may also wish to assure, through oversight and legislative action where needed, that executive branch coordinating procedures are adequate to develop and maintain consistent U.S. positions in GATT and the other international forums where services will be discussed (Option 2).

With a growing number of countries active in world trade, and with trade negotiations on more fronts, better analytical support has become a critical need for U.S. trade policy (Options 3-5). As OTA has noted elsewhere, Federal agencies could with little difficulty substantially improve their data on trade in services.[2] Better data will not be of much value to decisionmakers, however, without the analytical expertise to place it in long-term policy perspective. The desire to strengthen processes for formulating and implementing policy lies behind many of the proposals to create a new department of trade, or otherwise reorganize executive branch trade functions. By itself, trade reorganization would not necessarily accomplish this; but Congress could create better support systems—available should policymakers choose to call on them.

Regulatory decisions influence U.S. competitiveness in many ways—some direct, some indirect—particularly in sectors like banking and telecommunications, overseen by numerous agencies having overlapping or complementary responsibilities. Yet potential impacts on U.S. competitiveness rarely have much of a role in agency decisions; when they do, the matter is usually viewed as exceptional. Sooner or later, this will have to change, with decisionmaking, regulatory and otherwise, routinely encompassing competitive impacts: OTA's analysis points to the need for a better-developed institutional framework for dealing with the linkages between domestic policies and international competitiveness. Here, examples from banking and telecommunications provide the primary context for examining alternatives (Options 12-17).

Previous OTA assessments have consistently pointed to human capital as the foundation for internationally competitive industries. Americans will need new skills as their employers restructure and adopt new technologies. People with poor skills are most likely to lose their jobs as a consequence of restructuring. But compared with other industrial nations, the

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[2] *Trade in Services: Exports and Foreign Revenues* (Washington, DC: Office of Technology Assessment, September 1986).

U.S. Government provides little public support for adult education and training (Options 19-21). More emphasis on the development of instructional technologies also seems called for; computer systems pose fundamentally new opportunities at all levels of the educational system. Using them effectively will demand research and pilot projects (Options 22-24). Most generally, adapting an education and training system rooted in the 19th century to the needs of the 21st may well require a comprehensive overhaul of public policies. The first step is to reevaluate these needs and policies at the most fundamental level; the effort to reformulate human resources policies has hardly begun, despite the many studies of the U.S. educational system to appear over the past several years.

Throughout this report, OTA has stressed the interdependence of manufacturing and the services—with the competitive ability of U.S. firms in data processing and information services, for instance, depending on the competitiveness of U.S. computer and telecommunications equipment manufacturers, as well as software firms. Likewise, U.S. competitiveness in financial services stems in part from the excellence of the Nation's telecommunications infrastructure—and, more generally, from the ability of American companies to effectively utilize computer-based technologies of all kinds. As such examples suggest, the services depend on much the same technology/science base as manufacturing. Because the very idea of R&D in the services has been ill-defined and often unrecognized, the first step here is simply for Federal agencies to acknowledge the role of technology in service industries (for instance, by revising procedures for collecting data on R&D related to the services—Option 25).

But as the analysis in chapter 6 suggests, along with previous OTA reports, the Nation's technological problems go much deeper. In recent years, the political climate has been less than hospitable for Federal spending on applied research (except for defense) or commercial technology development; the Reagan Administration has been content to fund basic science, holding that this will suffice to rebuild the international competitiveness of American industries. Congress, in several pieces of legislation, has enacted a framework for a more comprehensive technology policy. As yet, the Administration has implemented only a few of the specifics in these laws. If Congress wishes to strengthen the Federal role in development and diffusion of commercial technologies, additional directives to the Administration may be required (Options 26, 27, and 31).

Finally, the Nation's overall policymaking system may itself need redefinition. Structural change in the U.S. and world economies has helped bring the problems into focus, but real change—in the sense of better coordination and integration of trade and domestic policies (as these affect both the services and manufacturing)—has yet to follow. Redefinition need not imply self-conscious attempts at reorganizing or reapportioning responsibilities for either trade or domestic policies, although there is no reason to rule these out a priori.

THE SERVICES IN U.S. TRADE POLICY

U.S. Trade Policy: Overtaken by Events?

Although the United States has worked actively to promote a liberal international economic order since the 1940s, our leadership has been called into question in recent years. And, with other nations catching up economically, a series of Administrations has been criticized for lacking policies suited to the new problems of maintaining U.S. competitiveness in a world of increasingly able competitors.

OTA's previous assessments of international competitiveness have stressed two points concerning trade policies and trade negotiations:[3]

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[3] See, in particular, *International Competitiveness in Electronics* (Washington, DC: Office of Technology Assessment, November 1983), ch. 11.

- Structural change in the world economy has outstripped the response capability, not only of GATT, but of U.S. trade law. Driven in part by technological change and in part by international business practices, patterns of production and trade now take forms that were not anticipated when the GATT framework was devised. In effect, governments have greater difficulty in defining national interests in a highly integrated global economy—one in which a fifth of U.S. imports (and much more for some products) represent shipments from American-owned affiliates abroad.
- National industrial policies, adopted by governments around the world, have also changed the rules of the game. Providing multiple forms of indirect support for domestic firms, industrial policies aggravate the problems posed by non-tariff barriers (NTBs) because many of the routine tools now used by governments can be viewed—i.e., by other nations—as trade restrictions or unfair forms of competition. The record remains mixed when it comes to the effectiveness of industrial policies, but it seems clear that many countries are learning to make steadily better use of them. Certainly, experience over the past two decades has taught foreign governments how to bargain more effectively with multinational corporations (MNCs), using the tools of industrial policy to shape economic development in accord with national goals (chs. 6 and 9).

Structural shifts and evolving practices in international business have affected trade and investment in the services fully as much as in goods-producing industries. So have national industrial policies, particularly in sectors like telecommunications.

Policymaking processes within the U.S. Government, as well as in bodies like GATT, have shown no more than modest capacity to adjust to the new realities. Whether in the steel industry or microelectronics, events now seem to move too quickly for the policy apparatus to respond. By the time trade complaints have moved through the system, and some resolution seems at hand—often a matter of years—the competitive landscape may have changed almost beyond recognition. Voluntary restraint agreements (VRAs) covering imports of machine tools, for example, came (at the end of 1986) a decade after the Nation's trade balance in these products turned negative, and more than 3 years after a request for relief by the National Machine Tool Builders' Association. More fundamentally, history offers little hope that, in an industry like this, VRAs will make much difference for competitive prospects.

The mounting U.S. trade deficit has resulted, on the one hand, in sector-specific trade restrictions like the machine tool VRAs. On the other hand, the United States has continued to advocate further liberalization of world trade—both rhetorically, and through concrete proposals in GATT and other international bodies. As events continue to unfold, it becomes more difficult for the government to reconcile the discrepancies between these two sets of actions. The enormous number of trade bills proposed in recent years—more than 700 introduced in the 99th Congress, 400 in the first five months of the 100th—shows the extent of concern. Congress enacted major trade laws in 1974, 1979, and again in 1984. Trade remained a prominent legislative concern during the 99th Congress—a concern that carried over into the 100th Congress.[4] In April of 1987, the House passed an omnibus trade bill (H.R. 3); in May, the Senate Finance Committee reported out its trade package (S. 490). (Other Senate committees were still at work on their contributions to comprehensive trade legislation.)

The Service Industries: New on the American Political Agenda

Trade in services has more visibility in policy circles than ever before, as reflected in actions taken by both Congress and the executive branch over the past dozen years. Since the early 1970s, business interests have sought to focus attention on barriers to services trade, with prominent corporations arguing that they have been underrepresented in previous MTN rounds. Banking and finance, insurance, tourism, motion pictures, telecommunications, and transportation got much of the early attention. In 1982, the first business organization concerned with the services as a whole emerged—the Coalition of Service Industries (CSI), with members ranging from banks to firms providing temporary help services. While the U.S. Chamber of Commerce includes a services group, and sectors like banking, insurance, and construction have had their own trade associations for years, CSI was the first organization formed to promote the interests of all services.

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[4] The House passed an omnibus trade bill in 1986 (H.R. 4800). While several major trade bills were proposed in the Senate during the 99th Congress, none was reported out of committee. See R.J. Ahearn, et al., "Trade Legislation: Comparative Analyses of H.R. 4800 and Selected Senate Trade Bills," Congressional Research Service report 86-740, June 10, 1986.

On the labor side, unions representing service industry employees—including the United Food and Commercial Workers, the Service Employees International Union, Communications Workers of America, and the American Federation of State, County and Municipal Employees—have been active much longer than CSI. In recent years, organized labor has placed a high priority on gaining members on the service side of the economy, where, in contrast to manufacturing, U.S. employment has been rising. Labor unions, however, have expressed deep reservations over bringing services into GATT; in part, this reflects a concern that the United States might need to give ground in manufacturing as the price of lower barriers to services trade.

In Congress, the most important initiative to this point has been passage of the International Trade and Investment Act, part of the Trade and Tariff Act of 1984 (Title III of Public Law 98-573). The Act gives primary responsibility for developing services trade policy to USTR; specific duties for the Department of Commerce include developing policies to increase the competitiveness of U.S. service industries (in consultation with other agencies), collecting and analyzing data on the services, preparing a biennial report for Congress and the President, and providing staff support to USTR on services-related trade issues. On a day-to-day basis, the Office of Service Industries (part of the International Trade Administration, ITA) has responsibility for Commerce's service industries development program. While the 1984 law provides a legislative mandate for coordination among the dozens of Federal agencies involved in services policy, it is far from clear that the executive branch has managed to implement it effectively. Nor had the initial report on Commerce's services program been submitted when the 99th Congress adjourned.

Negotiating Strategies in the Uruguay Round

During the new GATT round, negotiators will deal with services and goods on separate tracks. Other new issues will share the stage with services, as discussed in the preceding chapter, with intellectual property rights and counterfeiting, as well as trade-related investment, on the goods side of the agenda. In addition, the Uruguay Round will take up agricultural trade—a subject GATT has been unable to come to grips with in the past. With the new round scheduled to last until the fall of 1990, Congress will have ample opportunity to review progress and provide guidance to U.S. negotiators. An opportunity seems likely in 1987, as Congress looks at alternatives to renew fast-track approval processes for trade agreements. This or some other early occasion would give Congress the opportunity to take stock of U.S. negotiating strategies (Option 1, table 56).

The Tokyo Round showed ongoing congressional involvement to be desirable and most likely essential if U.S. negotiators are to bring back a politically acceptable agreement.[5] Many channels, formal and informal, can serve this purpose. Members of Congress—five from each house—serve as official advisors to U.S. MTN delegations. In this capacity, they can attend negotiating sessions, and are to be kept informed of all developments. Congressional committees with jurisdiction over trade can seek the views of, and provide guidance to, U.S. negotiators in executive session. Congress also

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[5] See R.R. Rivers, "The System CAN Work: The Trade Act of 1979," and R.S. Strauss, "Commentary: On Trade," *Making Government Work: From White House to Congress*, R.E. Hunter, W.L. Berman, and J.F. Kennedy, eds. (Boulder, CO: Westview, 1986), pp. 8-30.

Table 56.—Issue Area I: The Services and U.S. Trade Policy

Issue	Options for Congress	Comments
A. NEGOTIATING OBJECTIVES		
While negotiators need flexibility, close continuing contact with Congress is essential if the Administration is to secure a trade agreement acceptable to the legislative branch.	OPTION 1: While the Uruguay Round is in its early stages, Congress could provide specific guidance to the Administration on the outcomes it views as most critical to U.S. interests. This could take forms including: • informal congressional consultations with USTR, • requiring formal consultation and reporting at several junctures before the Administration seeks congressional approval of new GATT agreements; • legislative statements of U.S. negotiating objectives, possibly including objectives for specific service sectors. This could involve amending the relevant portions of the Trade Act of 1974 (e.g., Sec. 104A, added in 1984 to define broad goals dealing with services trade, foreign direct investment, and trade in high-technology goods).	The new GATT round raises fundamental questions concerning the U.S. role in the world trading system—matters going far beyond possible GATT coverage of the services: • In what ways would a stronger GATT serve U.S. interests? • Will U.S. initiatives in services trade and other new issues—and in agricultural trade—serve to strengthen GATT as an institution? Will some of them and not others? • Other nations will inevitably seek concessions in exchange for agreements that U.S. policymakers view as important. What sorts of trade-offs is the United States likely to face as we move into the Uruguay Round? • How will U.S. negotiators assign relative priorities to goods and to services when conflicts between the two arise during the discussions?
B. COORDINATION OF SERVICES POLICY		
Developing trade policies for services will require effective coordination among more than 30 Federal agencies (including numerous regulatory bodies) with responsibilities for services. U.S. negotiators will need to develop and present coherent positions at GATT and other multilateral forums, as well as in bilateral discussions.	OPTION 2: Also at an early point during the Uruguay Round, Congress could conduct oversight (and provide guidance and direction where needed) on executive branch coordination of services trade policy, under Title III of Public Law 98-573. In particular, Congress might use the oversight process to determine whether coordination is adequate for ensuring consistent U.S. positions in GATT and the other international forums where sector-specific and specialized issues (e.g., intellectual property protection) will be discussed.	Title III of Public Law 98-573 gave USTR responsibility for developing and coordinating services trade policy, using the interagency Trade Policy Committee (or its subcommittees). The law assigns Commerce the task of developing, in consultation with other agencies, policies to increase the competitiveness of U.S. service industries. Negotiations affecting trade in services may take place in other forums as supplements to or in parallel with GATT. Examples include OECD, the World Intellectual Property Organization, and the International Telecommunication Union. (See table 54 in ch. 9 for further examples.)
C. TRADE ANALYSIS AND DATA		
Better analytical support would make for better U.S. trade policy. Long-term policy planning is a particular need, given the protracted nature of negotiations in forums such as GATT, which often span two or more administrations and several Congresses. (Indeed, because the U.S. negotiating position may shift over time, other countries sometimes take a wait-and-see attitude before negotiating seriously.)	OPTION 3: Establish a new office for trade policy analysis, to provide continuing analytical support and institutional memory for executive branch decisionmaking. The office could focus on support for day-to-day decisions, on longer term policy development, or both.	The primary reason for creating a new trade policy analysis unit, rather than simply providing more resources to an existing office, would be to place the new group close to policymakers—and to staff and structure it accordingly.
The current database on trade in services is seriously deficient. Without better information, policymakers will have continuing difficulty devising negotiating strategies and weighing trade-offs among competing objectives.	OPTION 4: Conduct oversight on implementation of the International Investment and Trade in Services Survey Act (as amended in 1984) to determine whether some of the discretionary provisions for data collection should be made mandatory.	In Section 306 of Public Law 98-573, Congress amended prior law to give clear authorization to the President to collect data on trade in services, as well as to continue surveys on foreign investment. However, Congress left collection of services data discretionary; implementation of some surveys has been substantially delayed within the Administration (see Option 5).

Table 56.—Issue Area I: The Services and U.S. Trade Policy--Continued

Issue	Options for Congress	Comments
Many of the needed improvements in services data would entail changes in procedures of the Bureau of Economic Analysis (BEA), the Commerce Department unit that compiles trade statistics. The Administration has failed to approve some BEA proposals. Without a congressional directive, delays may continue.	OPTION 5: Direct the Commerce Department to take specific action to improve data on trade in services. Possible steps include: • surveying service transactions between unaffiliated firms (by proceeding with the BE-20 survey or a modified version); • expanding the Census of Service Industries; • altering BEA procedures for presenting royalties and license fee data to distinguish technology from other categories of intangible property, and to provide data on numbers of license agreements by year, and on receipts and payments on new license agreements in a given year.	OTA discusses further steps for improving the database on services trade in its special report, *Trade in Services: Exports and Foreign Revenues*. Also see Option 12 in table 59 on financial services.
D. SUPPORT FOR THE NEGOTIATIONS PROCESS		
Despite the growing number of issues on the Nation's trade agenda, budget and staff resources for negotiations remain modest. To be effective in GATT and other forums, USTR and other agencies will need increased support.	OPTION 6: Expand USTR's budget and staff to meet not only the heavy continuing workload expected over the course of the Uruguay Round, but also to carry on planning and preparations for subsequent negotiations, including those in other international forums.	As part of this process, Congress could direct the Administration to compile and annually update a statement listing the contributions of all Federal agencies to U.S. trade negotiations, and specifying measures taken by these agencies to maintain support at adequate levels.
If discussions on services trade move beyond the umbrella stage to sector-specific topics—and for such talks elsewhere—U.S. negotiators will need more input from service industries and their employees, and from users of services.	OPTION 7: Direct the Administration to establish several more Industry Sector Advisory Committees (ISACs) to speak for particular service industries, and several additional labor subcommittees to speak for their employees. To prepare for sector-specific talks—indeed, to help determine whether these would be desirable from the U.S. point of view—Congress could direct the Administration to establish and consult with the new advisory groups at an early date.	The trade advisory committee system authorized by Sec. 135 of the Trade Act of 1974 provides a mechanism for private sector input into trade negotiations. While an overall Services Policy Advisory Committee exists, only one ISAC (or two, counting that for wholesaling and retailing) represents the services at the sectoral level, compared with 14 for goods. (See Option 16 for discussion of telecommunications.)
Regulatory policies lie behind many of the barriers to services trade and investment, including regulations that serve important public purposes. Progress in reducing barriers will depend on willingness by countries to acknowledge and identify regulations that unnecessarily discriminate against foreign firms.	OPTION 8: Direct USTR (in cooperation with other agencies) to give high priority to evaluating both U.S. and foreign regulations that act, intentionally or incidentally, as non-tariff barriers to trade and investment in the services. By taking the initiative, the United States could encourage other major trading nations to examine their own regulatory barriers.	USTR reports annually to Congress on foreign trade barriers. The agency made a start on identifying U.S. regulations affecting trade in services when it prepared the U.S. national study on services, submitted to GATT in 1983. To reach agreements on reducing barriers to services trade, nations will first have to decide what topics are appropriate for discussion.

SOURCE: Office of Technology Assessment, 1987.

has the option of prescribing specific negotiating goals (e.g., as amendments to existing objectives in Sec. 104A of the Trade Act of 1974, as amended).

OTA's analysis suggests a number of specific issues that Congress could examine as it reviews prospects for the Uruguay Round:

- *How difficult will it be to take meaningful steps toward liberalization of trade and investment in services?* The obstacles seem real enough: 1) continuing resistance from developing countries and some industrialized nations, the latter mostly centering on sector-specific issues; 2) probable conflict within the U.S. Government over relative priorities for services and other concerns (i.e., agriculture, trade in manufactured goods); 3) resistance to liberalization of services trade on the part of some domestic interests.

  The International Engineering and Construction Industries Council, for example, has cautioned that bringing services into

GATT could mean costs as well as benefits to the U.S. E&C sector.[6] As for labor, the AFL-CIO continues to express its concern that the price of liberalization in the services might be further concessions on goods, leading to more imports, further erosion of the U.S. manufacturing base, and job losses.

Under these circumstances, U.S. officials have been forced to advocate selective liberalization of services trade. Easing entry for foreign workers is a politically sensitive issue; so are some kinds of NTBs. While many U.S. service firms would like to see GATT guidelines that would let them move professional employees freely from country to country, such an agreement would be hard to achieve without opening the way for, say, foreigners to work on construction projects here. Among the more notable NTBs affecting services, restrictions on shipping, such as the Jones Act in the United States—which limits domestic shipping to vessels built here, crewed by Americans, and flying the U.S. flag—would be difficult to change. (Many other countries have similar laws.)

- *How useful would an umbrella agreement on services actually be?* USTR seeks a broad and general set of principles that would create a framework for continued discussions in later years (see ch. 9, p. 298). Later in the Uruguay Round, negotiations under that umbrella, dealing with narrower topics and with specific service sectors, might or might not take place. One of the primary umbrella objectives, for example, is for all GATT members to concur in honoring the principle of national treatment for foreign-based service firms—meaning that domestic and foreign companies would operate under the same rules. Such goals seem sensible if abstract, and not very ambitious. While an umbrella agreement would set the stage for sector-specific talks, there are real questions about the ability of GATT to resolve the sticky political problems that would follow.

  For the United States, moving on to sector-specific subjects (bilaterally or multilaterally) would mean soliciting a good deal more input from individual service sectors and their employees. Lacking this, it is hard to see how U.S. negotiators could conduct an intricate series of bargaining sessions dealing with the particular problems of particular sectors.

  Regardless of whether sector-specific discussions take place during the Uruguay Round, a U.S. policy of conducting bilateral negotiations while the GATT deliberations continue seems unavoidable—indeed desirable (ch. 9). Moreover, multilateral discussions will also be proceeding in other, more specialized, forums. The International Telecommunication Union (ITU) has an important series of talks scheduled for 1988 and 1989, while the GATT ministerial declaration states specifically that the Uruguay Round discussions on intellectual property rights are not to prejudice initiatives in the World Intellectual Property Organization (WIPO) or elsewhere.
- *Is it realistic to expect GATT to deal with questions of investment?* Continued opening of the international economic system implies greater integration of trade and investment regimes; it has become increasingly difficult to retain the rather artificial separation between the two. Because international business activity in many of the services requires foreign direct investment (FDI), any substantial reduction in barriers to services trade implies a loosening of restrictions on FDI. But many developing countries view control over inward investment as a vital tool for steering economic development; they will resist any move to reduce their leverage. Indeed, some less developed countries (LDCs) may fear that talks on services are little more than a stalking horse for an agreement on direct investment.

  GATT itself has traditionally focused on trade, with investment issues a matter for bodies like the Organization for Economic Cooperation and Development (OECD) and the International Monetary Fund. In the Uruguay Round, trade-related investment —basically, the question of performance requirements (such as rules permitting FDI only on condition that some fraction of production be exported)—will be on the goods side of the agenda.

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[6] "IECIC Paper on GATT—March 20, 1986," International Engineering and Construction Industries Council, Washington, DC.

- *With so many highly contentious issues up for discussion, does the Uruguay Round promise to strengthen GATT, and thus help move the world economy toward greater openness?* Dependent on consensus among its members, and lacking in enforcement procedures, GATT appears weaker today than ever. With its ability, as now structured, to maintain a minimal level of discipline over goods trade in some doubt, would an agreement on services help to strengthen GATT? Put another way, if the objective is a stronger GATT, would it make more sense to concentrate on existing and widely acknowledged problems before taking up new issues?

Without teeth in GATT enforcement procedures, and without, for example, modifying the safeguards provisions—Article XIX, which permits governments wide latitude in negotiating "voluntary" restraint agreements or other import restrictions—there seems little prospect of reversing the incremental movement over the past decade toward a system of managed trade. If this movement continues, bilateral agreements and exceptions to GATT principles such as the Multi-Fiber Arrangement will eventually become the dominant reality.

If the United States really seeks a stronger GATT, fundamental problems such as these deserve high priority. If, on the other hand, the United States would prefer to continue withdrawing as champion of an open international economy, then a strategy of pursuing incremental changes that serve U.S. interests, rather than seeking more basic reforms of GATT procedures, becomes appropriate. Congress may wish to delve into such matters before the Uruguay Round moves too far into matters of substance.

In any case, given a range of services-related issues to be addressed in a range of international forums, effective coordination among the various U.S. delegations will be necessary (Option 2, table 56). As noted above, the Trade and Tariff Act of 1984 assigns both USTR and Commerce statutory responsibilities for coordination and consultation with other agencies on policies related to the service industries. At this point, it is not clear how well the procedures are working. Congressional oversight could reinforce the importance of coordination; Congress could also explore the possible need for additional legislation.

Trade Analysis and Information

This and other OTA studies have stressed the need for good information and analysis in support of trade policy (and domestic policies as they affect trade)—an especially critical need today, with international trade relations far more complicated than when GATT was established. Not only have many more nations become active exporters and importers, but the multinational corporations that now play such a prominent role in trade and investment hardly existed 40 years ago. Congressional action to strengthen the analytical support system for trade decisions could lead to better policy. So could improvements in the data on trade in services.

U.S. trade policy has become increasingly reactive over the past 10 or 15 years, responding primarily to immediate pressures—surging imports of machine tools or semiconductors, the fluctuating strength of the dollar. Lobbying by business, labor, and other interest groups focuses on matters of short-term advantage or disadvantage. For their part, politicians often tend to view interest groups as tactical allies in the short run, rather than partners in an ongoing effort to develop a coherent policy. Under these circumstances, trade policy can easily devolve into a string of contests over the topical issues of the day. In the absence of longer term perspectives, changes in the world economy and shifts in international competitiveness catch the United States unawares. Then the consequences—plant closings and layoffs, an enormous trade deficit, the Nation's new status as an international debtor—become the pressing realities, to be dealt with in a crisis atmosphere.

This process, in which long-festering problems percolate to the top of the policy agenda, to be dealt with (or dropped) so that Congress and the executive can go on to something else, contributes to the ad hoc decisions and eventual contradictions in U.S. trade policy touched on above. Domestically too, deregulation can be seen in part as a consequence of failure by government to find ways of coping with technological and structural change: pulling back may sometimes be the easy way out. (The positive side, of course, is that deregulation has helped many American industries to compete—e.g., in international banking.) Nonetheless, public recognition of the inter-relationships among international competitiveness, structural adjustment, and the Nation's standard of living has been growing. Policymakers seem more willing to acknowledge the links between foreign economic policy and domestic policy. The new GATT round could provide the opportunity for a major reassessment of the U.S. position in the world economy.

Analytical Support

The many proposals for reorganizing the trade responsibilities of the Federal Government reflect not only a sense of frustration, but a sense that new sets of institutional linkages between trade and domestic policy could lead to a more effective policymaking system. Some proposals would strengthen USTR, and give it more responsibility. Others would combine USTR with parts of the Commerce Department (and perhaps other agencies) to form a new department of trade, or department of trade and industry. Several proposals have called for a White House council on trade to replace or supplement the statutory (but largely inactive) Trade Policy Committee. As discussed in the section on "Organization and Effectiveness of Federal Policymaking" near the end of this chapter, most of these suggestions focus on the need to coordinate policy among executive branch agencies, with the heads of departments and agencies serving on the council.

Here, the fundamental point is that regardless of the structure of the policymaking system, better analytical capability would be an antidote to short-term thinking on the complex problems of trade and competitiveness (Option 3). The Uruguay Round is just beginning, and a new MTN agreement will probably not take effect until the mid-1990s. Action during the 100th Congress to provide better analytical support for U.S. trade policy could help the United States define objectives, weigh possible tradeoffs, and develop alternative negotiating positions as the new round unfolds.

At present, many agencies gather data and information on trade, but the data become useful to policymakers only to the extent that they can be placed in a meaningful framework. Should Congress create a department of trade, a small analytical unit, comprised of highly qualified professionals, would be a valuable addition to the agency. To help assemble the needed expertise, Congress could exempt the staff from normal civil service rules.[7] Such a step could also help preserve some of the vitality USTR has exhibited in the past. While it might be possible to achieve similar ends by building on an existing analytical group (e.g., one of those currently within ITA in the Commerce Department), the real need is for new approaches and unusually qualified people—placed close to the center of policymaking.

An alternative—e.g., if trade reorganization does not come to pass—would be to establish a separate analytical unit within USTR, or substantially expand USTR's small existing complement of analysts. Such a group would be in the right place—close to high-level executive branch decisionmakers. On the other hand, it would probably be difficult to insulate from USTR's day-to-day staffing needs, particularly at a time of heavy ongoing workload because of the MTN process itself. If Congress takes this route, it could help avoid these dangers by ensuring that USTR (and the other agencies involved in the Uruguay Round) have the resources they will need during the GATT talks (as discussed below). Finally, if Congress establishes a trade council in the Executive Office of the President, it could encourage the hiring and retention of highly qualified professional staff for long-term policy planning and analysis.

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[7] As OTA has suggested previously—"Statement of John H. Gibbons, Director, Office of Technology Assessment, Before the Committee on Governmental Affairs, U.S. Senate, May 12, 1983," *Trade Reorganization Act of 1983*, hearings, Committee on Governmental Affairs, United States Senate, Mar. 17, Apr. 26, May 11, 12, June 24, 29, Sept. 14 and 15, 1983 (Washington, DC: U.S. Government Printing Office), p. 264.

By their nature, the centers of policymaking responsibility in the executive branch have little institutional memory. People come and go; those that set policy tend to be well-removed from the analytical groups that do exist. Given this, any step to improve the analytical support for policy runs two risks. The group may end up submerged in the swirl of day-to-day events. Or it may become irrelevant. The first risk is unavoidable—if the people are good, those in charge will want to put them to work on immediate problems. If the people aren't that good, they will quickly become irrelevant in any case. In addition to the quality of the staff, political independence will be necessary: unless institutional memory can be preserved across administrations, the analytical function will be at least a partial failure. And of course, no structural change can do more than make policy support available for decisionmakers who choose to use it.

Data on Trade in Services[8]

Analysis depends on data, but the U.S. database on services trade is a poor one. Better procedures for gathering data, and for turning it into useful information, would make for better policy. Indeed, the current database on services trade seems distinctly inadequate for supporting the complex negotiations that would follow should the Uruguay Round move on to sector-specific issues.

The statistics compiled by the Bureau of Economic Analysis (BEA, part of the Commerce Department) seriously underestimate both exports and imports of services. The data are not only inaccurate, they are incomplete and lacking in detail. When it comes to trade in goods, BEA compiles data in about 10,000 categories; the services data can be disaggregated into perhaps 40 categories. The government collects no information on some types of service transactions. In other cases, collection methods leave gaps or large uncertainties. Some of BEA's categories mingle factor income (dividends, interest) and non-factor income (revenues for value-added services)—a fundamental conceptual difficulty. The uncertainties impair the ability of policymakers to gage the importance of services trade—as a whole, on a sector-by-sector basis, or bilaterally—making it more difficult to devise negotiating strategies and weigh trade-offs among objectives.

In 1984, Congress amended prior law, giving clear authorization to the President to collect data from American firms on their trade in services.[9] Congressional oversight on the Administration's progress in implementing the 1984 amendments may be appropriate; in particular, Congress might wish to ask whether some of the provisions for data collection should be made mandatory (Option 4).

OTA's special report, *Trade in Services: Exports and Foreign Revenues*, included 10 policy options for improving the services database. Two of the most important were (Option 5):

1. collect information on service transactions between unaffiliated firms (by implementing BEA's proposed BE-20 survey, or a modification);
2. expand coverage in the Census of Service Industries of overseas sales by U.S. service firms.

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[8] This section reiterates a number of major points from OTA's special report *Trade in Services: Exports and Foreign Revenues*, op. cit. The special report, prepared as part of this assessment, estimates the impact of services trade on the U.S. balance of payments, discusses current data collection procedures and their limitations (also see the section on "Measuring Services Trade" in ch. 2 of this report), and analyzes policy options for improving the data (pp. 7-11 of the special report).

[9] Sec. 306 of Public Law 98-573 redesignated Public Law 94-472 the International Investment and Trade in Services Survey Act, and gave the executive branch clear but discretionary authority to collect services trade data.

Photo credit: Port Authority of New York and New Jersey

Cruise ship docked in New York City

OTA discusses improvements in the data on international banking—likewise badly needed—in a later section of this chapter (see Option 12 in table 59).

Better information on international royalties and license fees would also help. For reasons explained in chapter 6, BEA's current procedures make it difficult to use the licensing data for examining questions of international technological competitiveness. For example, BEA lumps technical licensing payments with those for trademarks and copyrights on books and recordings. Nor does the agency separate figures on new licenses in a given year from ongoing payments under existing agreements.

Better data will do little good unless the government finds better ways to use it. But improving the database is a first step. The costs would be low. The benefits of better analytical understanding of trade and investment in the services, and the impacts elsewhere in the economy, should far outweigh any additional expense to the Federal Government or to industry.

Support for the Negotiations Process

USTR will need adequate resources—both budget and staff, and including people on loan from other agencies—to carry the burden of four years or more of GATT deliberations over and above its customary responsibilities. Moreover, if the Uruguay Round goes on to sector-specific matters, existing mechanisms for funneling information, suggestions, and recommendations from business and labor to U.S. negotiators will probably need to be expanded.

Staff and Funding for USTR

USTR's 90 or so professionals get regular help from other agencies, primarily the Departments of Commerce and Treasury. Even so, available resources have not kept pace with the growing number of issues and industries on the Nation's trade agenda. Besides the new GATT round, a partial listing of USTR responsibilities includes trade-related multilateral negotiations within OECD and the United Nations Conference on Trade and Development, plus a wide range of bilateral discussions. The agency also has the job of coordinating trade policy within the executive branch, along with Section 301 unfair trade practice complaints and administration of the Generalized System of Preferences. USTR must accomplish all this with a budget and staff that are small compared to the resources other nations devote to trade matters. For example, in the bilateral talks with Canada that began in 1986, fewer than a dozen U.S. representatives faced more than 80 Canadians, many of them experts with years of substantive experience in the issues under discussion.[10]

To handle its MTN responsibilities, USTR will need more people and more money (Option 6). The agency is seeking a modest increase in permanent staff for fiscal year 1988—from 136 positions in 1986 to about 145. ITA, which provides most of the assistance from Commerce during trade negotiations, is seeking 54 new full-time-equivalent positions for GATT-related activities, and a $4.1 million increase in its appropriation. Even so, budgetary pressures in the executive branch could jeopardize the support USTR depends on—not only people detailed on a nonreimbursable basis (16 in fiscal year 1986, with USTR reimbursing parent agencies for another 6), but the willingness of other parts of the government to detail highly qualified people under any circumstances.

USTR has other ongoing needs as well—outstanding among them, to continue its development of expertise and experience in negotiating with Japan. For the foreseeable future, bilateral talks with Japan will have a critical role in U.S. trade policy. USTR and Commerce have made real strides since the beginning of the decade in learning to deal with the Japanese. This capability needs to be maintained and strengthened.

Service Sector Advisory Committees

Particularly if it becomes necessary to prepare for sector-specific discussions (as opposed to negotiations concerning an umbrella agreement on the services), U.S. officials will want information and input from a broader spectrum of interests. Congress could direct USTR and other agencies (e.g., Commerce, Labor) to increase the number of advisory groups with members drawn from service industries and their employees (Option 7—also see Option 16 in table 59, on the need for a special advisory committee concerned with telecommunications). In some cases, representation by users of services might be appropriate.

As figure 50 indicates, USTR's Services Policy Advisory Committee represents the service industries at the most general level—but the services are only lightly represented among the Industry Sector Advisory Committees (ISACs, which advise both USTR and Commerce). One ISAC speaks for the services (or two, including that for wholesaling and retailing), compared with 14 for goods-producing industries. The interests of service industry employees also seem under-represented compared with other sectors. The Labor Advisory Committee on Trade Negotiations and Trade Policy meets regularly with USTR and the Department of Labor, but the one subcommittee for services (compared with five for goods-producing industries) has met only occasionally.

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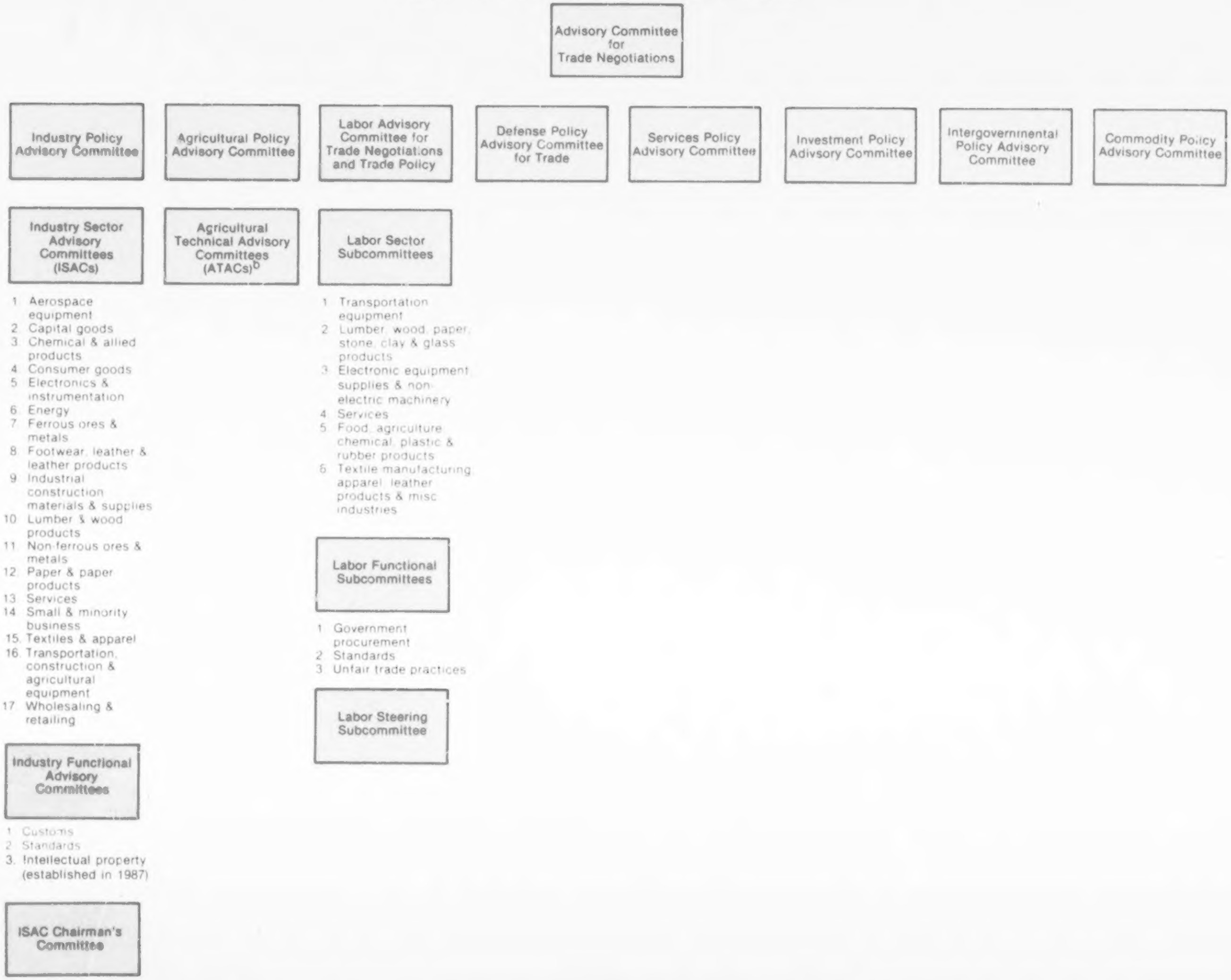
[10] B. Stokes, "Feeling the Strain," *National Journal*, July 19, 1986, p. 1770.

Figure 50.—USTR Advisory Committees[a]


Advisory Committee for Trade Negotiations
Industry Policy Advisory Committee
Agricultural Policy Advisory Committee
Labor Advisory Committee for Trade Negotiations and Trade Policy
Defense Policy Advisory Committee for Trade
Services Policy Advisory Committee
Investment Policy Adivsory Committee
Intergovernmental Policy Advisory Committee
Commodity Policy Advisory Committee
Industry Sector Advisory Committees (ISACs)
1. Aerospace equipment
2. Capital goods
3. Chemical & allied products
4. Consumer goods
5. Electronics & instrumentation
6. Energy
7. Ferrous ores & metals
8. Footwear, leather & leather products
9. Industrial construction materials & supplies
10. Lumber & wood products
11. Non-ferrous ores & metals
12. Paper & paper products
13. Services
14. Small & minority business
15. Textiles & apparel
16. Transportation, construction & agricultural equipment
17. Wholesaling & retailing
Industry Functional Advisory Committees
1. Customs
2. Standards
3. Intellectual property (established in 1987)
ISAC Chairman's Committee
Agricultural Technical Advisory Committees (ATACs)[b]
Labor Sector Subcommittees
1. Transportation equipment
2. Lumber, wood, paper, stone, clay & glass products
3. Electronic equipment, supplies & non-electric machinery
4. Services
5. Food, agriculture, chemical, plastic & rubber products
6. Textile manufacturing, apparel, leather products & misc. industries
Labor Functional Subcommittees
1. Government procurement
2. Standards
3. Unfair trade practices
Labor Steering Subcommittee

[a] Section 135 of the Trade Act of 1974, as amended, authorized the trade advisory system for the Office of the U.S. Trade Representative (USTR).

[b] Nine ATACs, not listed.

SOURCE: *Annual Report of the President of the United States on the Trade Agreements Program, 1984-1985* (Washington, DC: Office of the United States Trade Representative, February 1986, p. 180.

Non-Tariff Trade Barriers

Domestic regulations frequently act as NTBs, sheltering domestic firms from international competition (ch. 9). Many such regulations serve important purposes—public safety (licensing of physicians, building codes), protecting consumers against financial loss (supervision of banking, insurance, and brokerage firms). But they may be framed or implemented to discriminate against foreign firms. The United States—as the party that has pushed hardest to bring services into GATT—will probably need to take the lead in identifying and evaluating regulatory NTBs, including its own. USTR, with the help of other agencies, could begin by updating earlier work on U.S. regulations. Prompt action in identifying NTBs in the United States, as well as those in foreign countries, would be an example and prod to other governments (Option 8).

Other Trade-Related Issues

Among the narrower trade issues that surface when the subject is competitiveness, Congress has given particular attention to export promotion and export financing (table 57). The United States and Foreign Commercial Service (US&FCS)—lead agency for the Nation's overseas trade promotion efforts—seems distinctly understaffed and underbudgeted compared with its counterparts in other industrial countries. Policy issues in export financing have centered on foreign government subsidies and the

Table 57.—Other Trade-Related Issues

Issue	Options for Congress	Comments
Compared to many of its trading partners and competitors, the United States devotes only modest resources to export promotion abroad.	OPTION 9: Increase support for the overseas activities of the United States and Foreign Commercial Service (US&FCS), which is responsible for most of the overseas export promotion undertaken by the Federal Government. Raising the number of US&FCS officers overseas from current levels—about 200—to a complement of 300 or more would aid U.S. exporting in general. Congress could also direct the Service to provide training for its employees in the special needs and problems of the service industries.	Japan has about 5,000 overseas commercial officers; the United Kingdom and France each have 400 or more.
For years, the United States has sought to tighten a loophole in OECD guidelines on export credits that permits tied aid subsidies. In 1986, Congress authorized a 2-year, $300 million tied-aid war chest as part of the Export-Import Bank Act Amendments (Public Law 99-472). Substantially tighter OECD guidelines followed in 1987.	OPTION 10: Since other governments can always find ways to subsidize exports that they judge important for national interests, Congress could make plain U.S. resolve to keep such practices under control by continuing the authorization for the tied-aid war chest—and by funding it to match foreign subsidies, if this seems needed to get other OECD members to hold to the new agreement.	Greater budget outlays for export financing run counter to attempts to control Federal spending. As a result, some policymakers have sought to encourage private lending as an alternative to reliance on public funds. In 1986, Congress authorized a 2-year pilot program called I-Match as part of Public Law 99-472—a loan subsidy proposal put forward by the Administration. Under I-Match, private lenders will assume the lending risk, while the government subsidy—through Eximbank—reduces the interest cost to the borrower. In addition to monitoring the new OECD agreement, congressional oversight of the I-Match program could determine whether extension of this program, or other forms of export aid, might be needed to respond to export financing initiatives by other OECD nations.
The Trade and Development Program (TDP) finances feasibility studies and planning services by U.S. firms for projects in LDCs. Some of these studies lead to further work for U.S. firms, or to exports of goods.	OPTION 11: Increase TDP support from its current level of about $20 million annually—much smaller than similar programs in several other nations. Congress could also direct TDP to raise the number of feasibility studies conducted by U.S. firms on a reimbursable or cost-sharing basis.	TDP has particular relevance for the E&C industry. H.R. 3, as passed by the House in April 1987, proposed that a further $10 million be transferred to TDP during fiscal year 1988 for financing feasibility studies and for new responsibilities the program would be given.

SOURCE: Office of Technology Assessment, 1987.

ability of the United States to combat them or match them—matters that have been under discussion in the OECD since the middle 1970s. Potentially restrictive U.S. policies—notably the Export Administration Act and the Foreign Corrupt Practices Act—have also been widely debated. Chapter 6 gave brief mention to export controls and the uncertainties in their application. According to spokesmen for business, the Foreign Corrupt Practices Act, aimed at stopping bribery by American firms overseas, has also created uncertainty—in this case over what American companies can and cannot do in other parts of the world. There is little evidence, however, suggesting much impact on U.S. exporting or competitiveness.[11]

Overseas Promotion of U.S. Exports

The US&FCS maintains offices both in the United States and abroad, the latter mostly at embassies and consulates. The Service currently operates in over 60 countries, stationing nearly 200 commercial officers overseas and supplementing them with about 500 foreign nationals.[12] Officers in foreign countries supply marketing information to American firms and seek to promote U.S. exports. Among the service industries, engineering and construction probably stands to gain the most from the work of the US&FCS; commercial officers have also helped some American insurance companies win new business. Early involvement plays a crucial role in gaining new E&C contracts—personal contacts, knowledge of the local business environment, information on projects still in the planning stages.

Compared to other major trading nations, the United States devotes relatively few resources to overseas trade promotion. Table 58—which excludes State Department export promotion activities—shows that Japan has at least 20 times as many overseas officers as the United States; France and the United Kingdom have twice as many. Even including State Department personnel, only Italy, of the countries listed, stations fewer people abroad. Given current budgetary constraints, U.S. export promotion efforts could decline still further relative to our competitors without congressional action (Option 9).

Tied Aid and Export Financing

The Export-Import Bank of the United States (Eximbank) has primary responsibility for U.S. Government export financing programs. Eximbank extends loans to overseas purchasers of U.S. goods and services, provided the prospective U.S. exporter faces competitors supported by foreign governments. In 1983, Congress amended the Bank's charter, the Export-Import Bank Act of 1945, to specifically authorize loans for exports of services (Public Law 98-181). The Bank's Engineering Multiplier Program (EMP) —its major services-related activity—provides medium-term loans to foreign purchasers of U.S. architectural and engineering services.

Over the past few years, Eximbank's programs have been criticized by American firms as comparing unfavorably with loan packages available from other OECD governments. An OECD gentleman's agreement originating in 1976 (and modified several times since) covers subsidized export financing, but many member countries have taken advantage of a loophole exempting certain forms of tied aid (aid that requires purchases in the donating country); governments have been able to circumvent the agreement by increasing the grant portion of tied-aid financing packages. The French, who apparently originated this so-called mixed

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[11] See *Technology Transfer to the Middle East* (Washington, DC: Office of Technology Assessment, September 1984), pp. 557-559. Among the services, complaints over the Foreign Corrupt Practices Act come most often from E&C firms.

[12] These countries account for some 90 percent of U.S. exports—"Information submitted by the Department of Commerce for the Hearing record," *Departments of Commerce, Justice, and State, the Judiciary, and Related Agencies Appropriations for 1987*, hearings before a Subcommittee of the House Committee on Appropriations, U.S. House of Representatives, Part 9 (Washington, DC: U.S. Government Printing Office, 1986), pp. 482-489. In some 77 nations without a US&FCS officer, State Department economic/commercial officers have responsibility for export promotion, usually on a part-time basis. The State Department's Office of Business and Export Affairs estimates that its export promotion activities in these countries account for about 105 person-years annually—36 person-years on the part of foreign service officers, and 69 by foreign nationals.

Table 58.—Overseas Commercial Services Compared[a]

Country	Number of overseas officers	Total overseas personnel	Number of countries in which commercial representatives are stationed	Number of commercial posts	Overseas operating budget (millions of dollars)
United States[b]	192	723	64	125	$29
Japan	5,000	6,000	58	79	NA
United Kingdom	400	1,300	130	200	150
France	475	1,325	120	180	98
Italy	150	600	73	80	46
Federal Republic of Germany	241	NA	111	85	NA
Canada	262	460	78	102	30

NA = Not available

[a] As of 1985

[b] Includes US&FCS only, excludes U.S. management overhead.

SOURCE: United States and Foreign Commercial Service, Department of Commerce.

credit mechanism (because it mixes development aid and export credits in the form of loans), have used it quite aggressively. Italy and Japan, among others, have also looked to mixed credits to support their E&C industries.

In response to concerns raised by U.S. exporters, Congress included in its 1983 amendments to Eximbank's charter a provision calling on the bank to be fully competitive with its foreign counterparts, and established tied-aid programs to be jointly administered by Eximbank and the Agency for International Development (AID, the Federal agency responsible for channeling development assistance to LDCs). In part because of the differing mandates of the two agencies, the programs proved ineffective.[13] Most recently, as part of the Export-Import Bank Act Amendments of 1986 (Public Law 99-472), Congress provided for a separate tied-aid credit program and fund. The $300 million war chest authorized for fiscal years 1986 and 1987—to be administered by Eximbank in accordance with recommendations from the Secretary of the Treasury (and thus bypassing AID)—has been viewed as a defensive weapon, intended to create a sufficiently credible matching capability to persuade other nations to limit their own use of tied aid and other export subsidies. Subsequently, in March 1987, the OECD membership accepted a new and much more restrictive agreement on tied aid. Even so, continuing progress will probably require that the United States maintain pressure on other OECD countries (Option 10).

While the failure to counter foreign financing packages has cost American E&C firms (and telecommunications equipment suppliers) some sales to developing countries, government financing has seldom been important for exports by other service industries. Even for the E&C industry, it is not clear that financing—as opposed to factors like labor costs and the decline in Middle East oil revenues—accounts for that much of the overall decline in foreign business. But the primary point is a simple one: controlling the use of export subsidies means first persuading other nations that the U.S. Government is willing to match their subsidized financing packages.

Trade and Development Program (TDP, Option 11)

The TDP program finances planning and feasibility studies conducted by U.S. firms for developing nations (with up to 20 percent subcontracting to firms in the host country). TDP priorities have shifted over time, reflecting LDC development objectives; in 1985-86, much of the money went for studies on agribusiness, telecommunications, and hazardous waste management.[14] The program is intended to exploit linkages between feasibility studies and future exports in the design and construction phase of E&C projects (ch. 4), thereby stimulating U.S. exports. According to program officials, 166 feasibility studies over the period 1980 to 1983—which cost the government $29 million—had, by 1986, led to U.S. exports totaling $516 million.

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[13] The first Eximbank mixed credit package to be accepted came in May 1986, following 11 offers over the previous 7 months—"Eximbank Announces First Successful 'Mixed Credit' Deal, Clinching Contract in Gabon," *International Trade Reporter*, May 28, 1986, p. 709. In direct response to offers by the French and Japanese, the Bank agreed to provide $8.4 million at 2 percent interest, with an 8½-year grace period followed by a 20-year repayment schedule, coupled with a guarantee for a $12.8 million commercial loan. AID did not participate.

On the March 1987 OECD agreement, below, see "OECD Nations Ratify Agreement To Limit Use of Tied Aid in Subsidized Official Credits," *International Trade Reporter*, Mar. 18, 1987, p. 366.

DOMESTIC POLICY AND INTERNATIONAL COMPETITIVENESS

Many of the service industries, historically, have been heavily regulated. Because regulation serves public policy objectives widely regarded as legitimate and necessary, government policies will—despite the deregulation of recent years—continue to influence sectors like banking and telecommunications more heavily than typical manufacturing industries. Futhermore, the nature of the underlying policy objectives—e.g., consumer protection—almost guarantees that policymakers and regulators will pay more attention to the domestic than the international environment.

While government regulations—and deregulatory choices—influence the international competitiveness of American industry in many ways, policymakers seldom focus on these impacts. When they do, it is mostly in the direct and obvious cases—allocation of international air travel routes, telecommunications rates. But indirect impacts are pervasive as well. Banking regulations, by determining what American banks can and cannot do, constrain and mold the strategies of financial institutions. In the wake of the AT&T breakup, competition among U.S. telecommunications firms has become in part a contest to influence the newly emerging regulatory system, with each firm seeking advantages with respect to its domestic rivals. As the new regulatory system solidifies, telecommunications firms will turn more of their attention to marketplace competition.

This section examines banking and telecommunications more closely. Both illustrate issues that surface in many other service sectors (table 59).

The Example of Banking

Since the 1960s, international banking, driven by technological change and deregulation, has grown at an explosive rate (ch. 3). The business has changed much more rapidly than the regulatory and supervisory apparatus. While Congress has on occasion addressed questions of international competitiveness—notably in the 1978 International Banking Act (Public Law 95-369)—which extended national treatment to foreign banks operating in the United States, other issues have dominated ongoing debates over banking policy. Of several hundred banking-related bills introduced in the 99th Congress, most dealt with domestic financial services—or with such international issues as multilateral lending, the Third World debt crisis, and exchange rates. With very rapid international expansion by Japanese banks, policymakers here may begin giving competitiveness a higher priority.

As a first step, Congress could direct the Administration to improve the data on international banking compiled by Federal agencies. In its present form, the government's database does not even provide a clear indication that

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[14] "Congressional Presentation, Fiscal Year 1987, United States Trade and Development Program," *Hearings on Foreign Assistance and Related Programs Appropriations for 1987*, Committee on Appropriations, U.S. House of Representatives, Part 1, p. 1828. The 1987 TDP budget is about $20 million; program officials estimate that France and Japan fund similar efforts at levels over $100 million and more than $200 million, respectively. H.R. 3, as passed by the House in April of 1987, would substantially expand TDP's role in export promotion and export financing for bilateral projects involving development aid.

Currently, about 30 U.S. companies are supplying services and another 47 are providing goods for projects that have followed from TDP-financed feasibility studies—"Testimony of Christian Holmes, Director, U.S. Trade and Development Program, FY 87 Appropriations Request," *Foreign Assistance and Related Appropriations for 1987*, hearings, Subcommittee on Foreign Operations and Related Agencies, Committee on Appropriations, U.S. House of Representatives, Part 4 (Washington, DC: U.S. Government Printing Office, 1986), p. 440.

Table 59.—Issue Area II: Linkages Between Domestic Policies and International Competitiveness

Issue	Options for Congress	Comments
A. EXAMPLES FROM BANKING AND FINANCIAL SERVICES		
Current data collection procedures fail to provide a clear picture of banking exports and imports. Relatively minor changes in existing surveys could appreciably improve the database at little cost to the Federal Government or to financial service firms.	OPTION 12: Direct the Commerce Department's Bureau of Economic Analysis to improve its database on international banking and financial services, in consultation with the Federal Financial Institutions Examination Council, and its member agencies (e.g., the Federal Reserve Board).	Specific possibilities: • modify Federal Reserve Board reporting requirements to collect data needed for calculating banking exports; • add questions on receipts for services to the quarterly surveys of the asset levels of foreign banks operating here; • include financial service firms in BEA's benchmark and annual surveys of inbound and outbound direct investment.
Decisions made by the many Federal and State agencies that supervise and regulate banking can affect international competitiveness, creating a need to build consideration of these impacts into policymaking processes.	OPTION 13: Direct the Administration to provide an explicit mandate for an office of international competitiveness in banking to serve as a focal point for such issues, in particular the international ramifications of domestic policies.	The Treasury Department, which has already undertaken interagency studies on national treatment, would be an appropriate place for such an office. Congress could direct the Administration to establish a new group, or to expand Treasury's existing Office of International Banking and Portfolio Investment.
Domestic authorities, here and in other countries, have been hard pressed to keep up with rapid changes in international banking and financial services. Greater international coordination of bank supervision and regulation may be needed, along with an expansion to cover securities markets.	OPTION 14: Use oversight and reporting requirements to begin evaluating alternatives for greater international coordination of banking policies. One possibility would be to direct U.S. agencies that serve on the Basel Committee to explore ways of expanding the Committee's present activities.	Congress could also direct Federal agencies to examine and report on the desirability of creating a new international body for addressing issues of international coordination and harmonization of regulatory and supervisory policies.
B. EXAMPLES FROM TELECOMMUNICATIONS		
Restrictions on trade in both telecommunications equipment and services have hindered or halted the efforts of U.S. firms seeking to enter foreign markets.	OPTION 15: Congress could establish formal U.S. negotiating objectives for GATT and other forums dealing with telecommunications services and equipment.	Examples of possible objectives include: that U.S. firms be allowed to compete on an equal basis with host-country firms where foreign governments permit competition in telecommunications services; that, as users of foreign telecommunications services, U.S.-based firms not be subject to discriminatory terms, rates, and conditions.
To prepare for sector-specific negotiations on telecommunications, policymakers will need input from the full range of stakeholders. While telecommunications firms already have representation on some advisory committees, USTR currently has no separate advisory committee on telecommunications trade.	OPTION 16: Direct USTR and Commerce (in cooperation with other Federal agencies involved in telecommunications policy) to establish an Industry Sector Advisory Committee on telecommunications. The ISAC should include representation for users of telecommunications services and employees of telecommunications firms, as well as service providers and equipment manufacturers.	Because the interests of equipment producers, suppliers of services, and users often diverge, it might be desirable to create three subcommittees reporting to a telecommunications ISAC. (A separate private sector advisory process already exists to help the Department of State in preparing U.S. positions at the ITU—see Option 33 in table 61).
Because telecommunications is a vital portion of the infrastructure for the world economy, government policies have competitive impacts not only for equipment manufacturers and service providers, but also for users (including U.S.-based manufacturing companies, banks, and other service firms).	OPTION 17: Direct all Federal agencies with responsibilities for telecommunications to take into account in their regulatory and other decisions the interests of U.S. firms which are users of international telecommunications services, as well as suppliers of equipment and services. If Congress restructures the Nation's regulatory apparatus (e.g., by returning more authority to the FCC), it could take that opportunity to provide such directions.	It will be up to Congress, in the end, to redefine the roles of Federal agencies in telecommunications policy. Whatever the choices, it will be critical that the new structure give questions of international competitiveness high priority. Congress, for example, might give particular attention to the prospective role of the FCC, as an independent agency, in dealing with foreign governments and international bodies concerned with telecommunications.

SOURCE: Office of Technology Assessment, 1987.

liberalization of trade in financial services would benefit the United States. Congress could also consider giving the executive branch a stronger mandate for addressing issues of competitiveness on a continuing basis. Finally, it seems time to seek greater coordination of bank supervision and regulatory policies among nations, building on the groundwork laid by major banking nations at such forums as the Basel Committee. (Ch. 3 discusses a number of other policy issues related to the competitiveness of U.S. banks, including such questions as whether to relax or maintain the current separation between commercial and investment banking.)

Data on International Banking

While Federal agencies collect a great deal of information from banks, they do not collect it so that trade in international financial services can be measured and compared on the same basis as for other industries.[15] The result? It is impossible to assemble a clear picture of U.S. exports and imports of financial services—by value or by type of product.

Improving the database would not require large expenditures by government, nor much additional paperwork on the part of banks. Several Federal agencies, including BEA, the Federal Reserve Board (FRB), and the Treasury Department already collect much of the needed information. Expanding the FRB's quarterly monitoring of the U.S. branches of foreign-based banks to include receipts would greatly improve the data on imports of financial services. As another example, it would take only minor modifications in FRB reporting requirements to begin collecting information on services provided within the United States by the foreign branches of American banks (relative to their functions as overseas sales outlets). Because BEA compiles most trade data, Congress may wish to direct the Bureau, in cooperation with the FRB and other banking agencies, to improve its database on international financial services (Option 12, table 59).

Raising Priorities for International Competitiveness

Few of the agencies that exercise regulatory or supervisory authority over financial services institutions pay much attention to competitive impacts. In addition to the FRB, these agencies include the Office of the Comptroller of the Currency and the Federal Deposit Insurance Corporation (FDIC); the Securities and Exchange Commission, the Department of Justice, and State regulatory bodies also have some measure of responsibility for financial services. Enhancing the international competitiveness of the U.S. industry has never been the primary objective of any of these agencies, nor should it necessarily be. Yet as discussed in chapter 3, regulatory decisions can affect costs quite directly, while in other cases regulatory agencies provide services to banks; the FRB's clearing and settlement functions help make the U.S. banking infrastructure the best in the world. These and other examples suggest that banking agencies need to be concerned with the impacts of a broader range of international competitiveness issues than, say, the question of whether U.S. banks operating abroad get the same degree of national treatment and competitive equality as extended to foreign banks here under the International Banking Act.

Perhaps the most direct approach for fostering this broader perspective would be for Congress to charter a special office in the executive branch to serve as a focal point for integrating competitive impacts into policymaking and for coordination among agencies (Option 13). The function would, for example, fit logically into the Office of International Banking and Portfolio Investment in the Treasury Department. Treasury has coordinated past congressionally mandated analyses of foreign government policies as they affect U.S. financial services firms—the national treatment studies first called for by the International Banking Act.[16] If assigned this broader task, the of-

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[15] *Trade in Services: Exports and Foreign Revenues*, op. cit., pp. 8-9, 53-58, and 77-79.

[16] See "National Treatment Study: Report to Congress on Foreign Government Treatment of U.S. Commercial Banking and Securities Organizations, 1986 Update," Department of the Treasury, Washington, DC, December 1986 (like earlier studies in 1979 and 1984, prepared in conjunction with the Department of State, the Federal Reserve Board, the Comptroller of the Currency, and the Federal Deposit Insurance Corporation). The 1986 report includes, for the first time, coverage of the securities industry.

Photo credit: Chicago Board of Trade

Futures trading

fice could continue monitoring restrictions imposed by other countries, as well as analyzing the international competitive position of the American industry and the effects of U.S. banking policy on competitiveness.

International Coordination

Rapid expansion and new financial products—particularly in lightly regulated offshore markets—create possible new sources of instability in the international banking system, as discussed in chapter 3. With world financial markets more tightly coupled, it will be increasingly difficult for any one country to maintain an independent banking policy. The implication? Greater international coordination of supervisory and regulatory policies may benefit all countries. Even more, harmonization of such policies may be necessary for ensuring the stability of the system.

In other sectors where interdependence has been a fact of life, international organizations have evolved where nations can meet to discuss rules and resolve disputes. GATT provides these functions for trade in goods. For more than a hundred years, the ITU has done so in communications. Bodies like the International Maritime Organization and WIPO are well-established fixtures on the world scene. In contrast, the international regime for financial services seems undeveloped. GATT has more than 90 members, the ITU 160, but the so-called Basel Committee—the most influential of the analogs to such organizations for banking—consists of central bank representatives and supervisory authorities from only 11 countries. (The proper name of this group, which meets at the Bank for International Settlements, is the Committee on Banking Regulations and Supervisory Practices.) Formed in 1974, the Committee's meetings are confidential, with little information available to the public. The OECD does address related issues, including securities. Its Committee on Financial Markets established an Expert Group on Banking in 1980 to examine changes in banking practices and regulations. Several regional groupings of bank supervisors also exist—e.g., within the European Community (EC).

Much of the work of the Basel Committee has concerned supervision and regulation of foreign banking offices.[17] Operating by consensus, with recommendations having no legal force in member countries, the Committee has nonetheless been able to make progress in some areas—for example, by establishing the principle that all foreign bank offices should be subject to supervision, and agreeing on the division of supervisory responsibilities between parent and host countries.

Strengthening and expanding the Basel Committee, or otherwise developing a framework for international coordination of banking policies, promises to be a long-term endeavor. The special relationships between governments and financial institutions—which stem in part from the role of banks in implementing monetary policy—lead to sensitivities not found in other sectors. Furthermore, many governments have used their banking systems as instruments of industrial or social policies—e.g., to steer resources to favored sectors of their economies. These governments might fear, quite naturally, that a more open system would threaten their ability to achieve national goals. Because of such sensitivities, the Basel Committee has gone to some lengths to stress that it is simply an organization of central banks (or supervisory authorities), not of governments.

OTA's analysis of recent trends in international financial markets and the implications for stability points to a need for better international coordination. Congress, on occasion, has called on U.S. banking agencies to work toward such coordination.[18] As a next step, Congress could request a study of the effectiveness of possible mechanisms for harmonizing banking regulations among countries (Option 14). It could, for example, ask whether a new international institution might be desirable, or whether the Basel Committee (or perhaps the OECD) could provide a suitable venue. Congress might direct Treasury or other Federal agencies to report on these questions, and to discuss alternatives with foreign countries (while recognizing the reasons for the confidential nature of the Basel Committee's proceedings, and the secrecy with which some governments conduct banking policy). International coordination of regulations that affect the securities industry should be part of this process. Although the analysis in chapter 3 suggests that it may be desirable to move toward supranational regulation and supervision of financial services, greater coordination of current practices is the necessary first step.

The Case of Telecommunications

With the AT&T breakup, the United States opened its markets to foreign equipment suppliers without seeking reciprocal actions by other countries. Meanwhile, deregulation helped stimulate the emergence of new U.S.-based suppliers of telecommunications services (e.g., value-added networks, or VANs, ch. 5). Many of these companies are interested in selling abroad, contributing to pressures for greater access by U.S. companies to foreign telecommunications markets for both services and equipment.

But a focus simply on suppliers of equipment and services would undervalue the significance of telecommunications to U.S. firms. With telecommunications becoming a central element in corporate operations and strategy, the regulatory practices of foreign governments have implications for competitiveness in many industries. In most parts of the world, PTTs—government post, telegraph, and telephone authorities—not only monopolize domestic markets for basic telecommunications, but also limit and/or regulate entrants seeking to provide enhanced services like VANs. Sometimes PTTs make it difficult or expensive for MNCs to operate dedicated international networks.

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[17] *International Banking—International Coordination of Bank Supervision: the Record to Date*, GAO/NSIAD-86-40 (Washington, DC: U.S. General Accounting Office, February 1986).

[18] For example, in the International Lending Supervision Act of 1983 (Public Law 98-181), Congress emphasized the importance of assuring consistent supervisory policies for international lending, directing Federal banking agencies to consult with other countries on measures for achieving this.

From the perspective of competitiveness, primary U.S. interests include:

1. access for American firms to public switched networks on reasonable and nondiscriminatory terms (e.g., rates roughly reflecting actual costs, freedom to connect advanced equipment to public networks);
2. minimal transborder data flow (TBDF) restrictions, such as requirements for local storage or processing of data;
3. freedom for users to resell or share leased lines, or otherwise bypass portions of the public infrastructure (particularly important for smaller companies that otherwise might find wide-area networks prohibitively expensive);
4. openness to foreign investments by U.S.-based service suppliers; and
5. reductions in barriers to trade in telecommunications equipment (including restrictions on the equipment MNCs can install to support dedicated applications and internal networks).

These issues have the potential to affect a wide array of users, including host-country firms. Some of the latter could prove helpful allies in efforts to loosen foreign government restrictions.

Numerous bills dealing with trade in telecommunications have been proposed in recent Congresses. Many deal with equipment, others address services, some cover both. H.R. 3, as passed by the House in the spring of 1987, included a separate title on telecommunications hardware and services. The bill would direct USTR to identify countries with barriers to U.S. telecommunications exports and enter into negotiations with their governments Failure to reach agreement could lead to countermeasures by the United States.

At this point, however, the U.S. Government does not appear very well organized to pursue such issues. Predictably enough, no one Federal agency has authority for international telecommunications policy. A half-dozen or more bureaus and offices within the FCC have some degree of international responsibility; in 1981, a new position—Assistant to the Chairman for International Affairs—was created to oversee their activities, along with an International Telecommunications Coordinating Committee. Even so, most of the FCC's responsibilities remain focused on the domestic scene, where regulations remain in flux in the wake of the AT&T breakup.

An array of other government agencies share in representing U.S. interests internationally. USTR has the lead role in GATT. The State Department represents the United States in the ITU and its Consultative Committee for International Telephone and Telegraph (CCITT). Within the Commerce Department, ITA and the National Telecommunications and Information Administration have responsibilities, respectively, for analysis of the telecommunications industry and for advising the President on policy. The Administration has also set up an interagency group for telecommunications policy that meets on an ad hoc basis. Finally, bodies like the Cabinet-level Economic Policy Council (EPC) have an occasional say in matters related to telecommunications trade. Domestically, Judge Harold Greene's court continues as primary overseer of the AT&T settlement agreement—which itself has international ramifications, in part simply because of the many uncertainties that remain concerning the future direction of regulatory policy in the world's biggest market.

Again, the primary needs seem to be, first, providing sound analysis in support of policy, and second, ensuring adequate coordination among Federal agencies. Both are prerequisites for taking prompt advantage of opportunities as they emerge internationally. For example, the primary thrust of past U.S. trade policies, as related to telecommunications, has been to seek open markets for U.S. equipment. While desirable, and consistent with the overall thrust of U.S. trade policy, it would seem appropriate to raise the priorities for telecommunications services at least as high. With many foreign governments determined to continue protecting their equipment markets—and quite able to do so for years, if they wish—greater progress may be possible on the services side.

A legislative statement of negotiating objectives could lead to a clearer sense of priorities within the government, as well as emphasizing U.S. resolve to other countries (Option 15, table 59). Because the interests of equipment manufacturers, service providers, and users frequently diverge, it also seems appropriate to broaden the advisory process for telecommunications trade: Congress could direct USTR and Commerce to establish an ISAC solely for telecommunications, with representation from the full range of interested parties, including users and labor (Option 16). Such a step would become especially important if sector-specific negotiations on telecommunications begin during the current GATT round; it could also help lay groundwork for deliberations in other forums.

Resolution of the currently unsettled regulatory environment in the United States could have major impacts on competitiveness. Since the AT&T antitrust agreement, domestic regulatory authority has been shared by the FCC and Judge Greene's court, together with the Justice Department. At some point, new legislation will necessarily replace these makeshift arrangements. An Administration-supported bill proposed but not enacted in the 99th Congress (S. 2565) would have redefined FCC authority in light of past legal decisions, reestablishing the Commission's primacy with respect to domestic telecommunications. With the stakes for contending U.S. firms so high, any new legislation promises to be highly controversial; it may take years to resolve such matters. Here the point is simply that domestic telecommunications regulations do affect international competition, but that at present the impacts probably get too little attention (Option 17).

A final set of questions stems from the possibility that telecommunications carriers (both in the United States and abroad) may move toward different technical standards for Integrated Services Digital Networks (ISDN, chs. 5 and 9). Incompatible standards could raise costs and substantially reduce benefits to users. Prior to the AT&T breakup, most of these technical matters could be left to the deliberations of standard-setting bodies. Now, with competing companies here and abroad seeking to shape standards to give them an edge over their rivals, technical questions once viewed as arcane by the policy community have entered the wider political arena. As discussed in a later section of this chapter on "Technical Standards," policymakers will need to monitor the evolution of ISDN both here and abroad on a continuing basis (see Option 30 in table 61).

HUMAN RESOURCES POLICIES

The international competitiveness of American industry depends ultimately on human capital, and thus on human resources policies. Beyond this, rapid economic change, placing new demands on firms and their employees, brings new needs for education and training. Rapid structural change also brings new questions: In what proportions should companies and workers share in retraining costs? Will educational technologies like computer simulations and interactive videodiscs lead to improvements in the quality of training/retraining programs? To greater productivity and lower costs? How can reform of public education contribute to flexibility, and to the ability of people to continue learning during their working lives? What would broader based post-secondary vocational curricula, suited to the evolving needs of the service industries, look like?

Rapid and often wrenching change has become a hallmark of the U.S. economy. American companies, more exposed to international competition than in the past, must adapt in order to survive. As these firms restructure and automate, some workers lose their jobs. Others find themselves asked to move into fundamentally different kinds of work. Flexibility for the employer may bring uncertainty if not instability for the employee, illustrated by the many cases in which U.S.-based firms have responded to competitive pressures by hiring greater numbers of part-time and temporary workers (ch. 7), or by moving production offshore. Policymakers, here and in other industrialized countries, find themselves seeking to balance conflicts between job security and a flexible and efficient labor market.

When it comes to education, training, and skill development, the questions look much the same inside the service sector or outside it. Broadly similar patterns of computer utilization exist in the services and in manufacturing; problem-solving and learning skills will be much the same (ch. 8). As more firms reorganize work and incorporate computer-based systems, more Americans will be faced with worklife adjustments and transitions—in a word, with the need for retraining.

Demographic shifts promise to make some of the coming adjustments more problematic. The aging of the baby boom generation will be felt for years to come: by the year 2000, half the Nation's labor force will be middle-aged (35 to 54), compared to about one-third today. In the past, some companies have been reluctant to retrain middle-aged employees. Meanwhile, many older Americans have been reluctant to seek out adult education and (re)training on their own. Companies confronting a shrinking pool of recent graduates with the latest specialized training may be forced to strengthen their internal training and retraining programs.

Reevaluation of Human Resources Policies

Adapting the American education and training system—primary and secondary schools, community colleges and universities, continuing education, retraining for displaced workers—to emerging needs may pose real difficulties. Over the past few years, more than a dozen commissions and study groups have called for educational reform. No consensus has emerged on what needs to be done. Indeed, it is hard to see the outlines of a meaningful debate through the slogans. Distasteful as it may be to suggest more studies, this seems necessary: OTA's analysis indicates that a more fundamental reexamination and debate than yet seen—one focusing on *specific* changes in human resource policies that might best serve the U.S. economy in years to come—would serve decision-makers well (those in the private sector, as well as in Federal, State, and local government).

To be useful, such a reexamination will have to address a broad range of issues—education and training in their deep as well as obvious senses:

- What should be the nature of a liberal education in the 21st century? If the need for work declines, can we educate people in ways that help them find satisfaction in other ways?
- What is the character of the skill base on which industrial competitiveness depends? Even "unskilled" workers must possess a wide range of abilities: social and communications skills; some kinds of problem-solving capabilities. More highly skilled workers rely on broader and deeper stores of tacit know-how (anticipating problems, troubleshooting). How do formalized programs of education and training contribute to the skills people actually use in the workplace?
- In terms of industrial competitiveness, what kinds of skills will be most vital in the future? How will postindustrial skills differ from those of the past? Can a postindustrial economy have a true oversupply of technically skilled people?
- To what extent can improving the skills of the U.S. labor force, or changing the mix of skills in the labor pool, help drive economic growth, thus mitigating structural unemployment and underemployment?

- Will the invisible hand provide for future skill needs? Will the existing U.S. education /training system respond quickly enough to shifting needs? Will gaps between those with skills and those without become more difficult to bridge?

Beyond such questions, the debate needs to include labor law and employee benefit policies.

Congress could launch such a reevaluation if it wishes (Option 18, table 60). One approach would be to assign the task to an existing body within the executive branch. Alternatively, Congress might create an independent forum (e.g., a council or institute, with a mandate to report and make periodic policy recommendations to Congress and the President). If Congress establishes an industrial competitiveness council or similar advisory organization (as has frequently been proposed), it could explicitly direct the council to include human resources and human capital among the policy issues addressed.

Adult Education and Training[19]

Already large, the U.S. system for adult education and training continues to grow. But despite its breadth and scope, the system does a poor job of meeting the training and retraining needs of those with non-professional and non-supervisory jobs. This is true in both the services and for blue-collar workers in manufacturing.

In many respects, the system helps those who need it least. Managers, administrators, and professionals have many opportunities to maintain and improve their skills; so do some skilled workers and paraprofessionals. Companies are much less likely to provide training for those having low skills to begin with, while few of these adults look to vocational institutions—whether profit-seeking trade schools for barbers and computer programmers, or community and junior colleges—for help in adapting to changing job conditions or in making career shifts.

Congress has been aware of this problem, and in several recent laws has authorized programs to broaden opportunities for work-related adult education and training:

- In 1982, Congress created a major new program for displaced workers under Title III of the Job Training Partnership Act (JPTA, Public Law 97-300). Title III provides funds to States for projects that offer displaced workers reemployment services, including vocational skills training and remedial education.[20] Although the broadest Federal program for displaced workers, Title III reaches fewer than 5 percent of those eligible. Most of the State programs seek to place people in new jobs as quickly as possible, rather than providing training. Remedial education gets little attention, even though perhaps 20 percent of JTPA participants have trouble with reading, writing, and arithmetic.[21]
- The Carl D. Perkins Vocational Education Act of 1984 (Public Law 98-524) allows States to spend part of their basic Federal grant for vocational education on adult training for those who are currently employed, as well as those who are seeking jobs (or are threatened with displacement). The Act also authorizes special grants (as yet unfunded) to States for adult training and industry-education partnerships for training in high-technology occupations.

Despite such initiatives, the U.S. Government provides less support for adult education and training than other industrialized countries such as Canada and France. In its previous work, OTA has examined policy alternatives for adult training, retraining, and education in detail—an analysis suggesting a more active and

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[19] See, in general, *Technology and Structural Unemployment: Reemploying Displaced Adults* (Washington, DC: Office of Technology Assessment, February 1986), pp. 274-289.

[20] *Technology and Structural Unemployment: Reemploying Displaced Adults*, op. cit., pp. 163-165. The Administration, as part of President Reagan's competitiveness package (the Trade, Employment and Productivity Act of 1987, H.R. 1155 and S. 539), has proposed a Worker Readjustment Assistance Program to replace JTPA Title III (and other programs).

[21] A recent survey found most Americans aged 21 to 25 to be literate, but only a relatively small proportion were proficient at literacy tasks of any complexity—a finding with discouraging implications for the future of knowledge-based service industries. See I.S. Kirsch and A. Jungeblut, *Literacy: Profiles of America's Young Adults* (Princeton, NJ: National Assessment of Educational Progress, 1986).

Table 60.—Issue Area III: Human Resources

Issue	Options for Congress	Comments
A. EVALUATION		
Despite numerous commissions and task force reports, no consensus has emerged on adapting education, training, and other human resources policies to the new circumstances resulting from U.S. immersion in the international economy.	OPTION 18: Call for a fundamental reexamination of human resources policies, and an evaluation of specific steps to enhance the ability of Americans to adjust to shifts in labor market and workplace conditions resulting from international competition.	Congress could charter an independent council or institute to report and make specific policy recommendations. Or it could ensure that human capital issues get a prominent place in the mandate of any council or other body established by Congress to examine and make policy recommendations on international competitiveness.
B. ADULT EDUCATION AND TRAINING		
A work force with good skills is essential for maintaining U.S. competitiveness. While some companies provide broad-based education and training for their employees, others do little or nothing.	OPTION 19: Direct the Administration to undertake pilot and demonstration projects, in cooperation with business and industry, on new approaches to training and retraining of active workers. Involvement by organized labor would also be desirable. Such programs would not require new authorization.	In its 1986 amendments to JTPA (Public Law 99-496), Congress authorized the Secretary of Labor to fund pilot projects for training people "threatened with loss of their jobs due to technological changes, international economic policy, or general economic conditions." As an alternative, the Carl D. Perkins Vocational Education Act of 1984 (Public Law 98-524) provides for a special State grant program for adult education and retraining—including training designed cooperatively with employers—which has never been funded. Congress could fund this program, and specify that part of the appropriation be used for broad-based training of employed adults.
Demonstration projects alone will not lead to major increases in training for employed adults. Cost-sharing with businesses (either directly or indirectly) might increase training opportunities, but—in the absence of alternative funding mechanisms—would run counter to deficit-reduction objectives.	OPTION 20: Consider alternatives to increase the national commitment for training and retraining of the adult work force, including incentives for employer-provided education and training and new sources of funding.	Proposed alternative funding mechanisms have included: increased direct Federal expenditures for cost-sharing; tax credits for firms that provide certain kinds of training; a payroll-based tax to fund retraining services for workers; and a small uniform tariff, imposed on all imports (after seeking GATT acceptance) to fund worker adjustment programs.
Many service jobs, including those for which a high school degree once sufficed, now require specialized vocational-technical training. Beyond job- or occupation-specific courses, general vocational curricula that would provide a foundation for continuing (re)training could help people in the knowledge-based industries adapt to future workplace changes.	OPTION 21: Direct the Department of Education, in cooperation with the Department of Labor, to fund demonstration projects for broad-based vocational curricula, focusing on generic skill development for the knowledge-based services. Grants could be made available to both public vocational-technical schools and proprietary (trade) schools.	Business and industry should be actively involved in any such experimental and demonstration projects. The Carl D. Perkins Vocational Education Act of 1984 provides a suitable vehicle—through the authorization for cooperative demonstration programs, or for special State grant programs for industry-education partnerships. Congress would need to earmark funding if it proceeds with this option.
C. INSTRUCTIONAL TECHNOLOGY		
The Federal Government, especially the military, has developed a great deal of technology and instructional material for training. Some of this could be useful to the private sector and the schools, but only limited information has been easily available to educators and private sector trainers.	OPTION 22: Direct the Administration to give priority to timely completion of the feasibility study for an inventory of federally funded training software called for by the Federal Technology Transfer Act of 1986. Should it seem appropriate once the feasibility study has been completed, direct the Administration to proceed with the inventory.	Congress called for the feasibility study in the Federal Technology Transfer Act (Public Law 99-502), which amended the Stevenson-Wydler Technology Innovation Act of 1980 (Public Law 98-480). If the feasibility study—due in October 1987—is done well, it should help Congress determine whether to direct the Administration to proceed with the inventory itself.
Transfer of training technology from the government to schools and to the private sector may involve several agencies, as well as requiring modifications to course materials.	OPTION 23: Instruct Federal agencies to place more emphasis on transfer of training technology and course materials to public institutions and corporations, initially through technology transfer mechanisms as authorized in Public Law 96-480. Congress could follow with oversight to determine whether new mechanisms should be created specifically for diffusion of training technologies.	Examples of executive branch efforts to transfer training technology include a computer-assisted reading program developed by the Navy and transferred to some libraries. On a larger scale, the Departments of Defense and Education have been cooperating on methods of transferring the Army's computer-based basic education program.

Table 60.—Issue Area III: Human Resources—Continued

Issue	Options for Congress	Comments
Realizing the long-term potential of instructional technology will require continuing research on teaching and learning. Beyond R&D and the development of new teaching and training materials, dissemination of new methods—including computer-based training—will require ongoing Federal support.	OPTION 24: Increase funding for research, development, evaluation, and dissemination of instructional technologies—including adult education and training. One approach would be to direct the Department of Education to establish and provide partial funding for a research center concerned specifically with adult learning, and including R&D on instructional technologies.	Federal funding for such a program—which might be the responsibility of the Department of Education's Office of Educational Research and Improvement—could be kept modest by requiring matching grants from foundations and the private sector, which stands to benefit substantially. Congress, in the Higher Education Amendments of 1986 (Public Law 99-498), called for a national program of research on adult learning—without, however, authorizing funding.

SOURCE: Office of Technology Assessment, 1987

more positive Federal role that might entail steps such as:[22]

- Greater funding for outreach and delivery of services under the Adult Education Act, as amended in 1984 (Public Law 98-511). This is the largest Federal program that supports State and local adult basic and secondary education; with more funding, a wider array of basic skills programs geared to workplace needs, and involving companies and labor unions, could be offered without reducing services to those not at present in the labor force.
- More effective outreach programs at the community level on postsecondary educational opportunities for adults.
- Targeted Federal assistance for retraining workers with jobs in contracting or vulnerable industries, aimed at avoiding some displacement problems to begin with (i.e., by increasing both lateral and vertical mobility within the Nation's labor market).
- Making it easier for people with jobs to qualify for Federal financial assistance to continue their education on a part-time basis.

Any and all of these steps would help, but perhaps the single most pressing need is to find ways of stimulating company-run education and training programs for lower-level employees. As outlined in chapter 7, many American companies have sought to adjust to new competition by relying more heavily on a contingent workforce—e.g., temporary and part-time employees—rather than seeking to improve the skills and flexibility of existing employees. When companies do provide training for lower-level workers, the programs tend to be narrowly focused (e.g., instruction in the use of new equipment). This not only keeps costs down, but reduces the chances that employees will take a job with another firm, perhaps a competitor. Companies safeguard their investment —at least in the short term—by concentrating on job-specific and firm-specific know-how, rather than transportable skills. But society as a whole might reap greater gains from a broader and deeper approach.

How can Federal policies address these disincentives, and encourage more comprehensive company programs for continuing education and training? Demonstration projects for experiments with new ways of integrating work and learning offer one approach (Option 19). Far more comprehensive proposals have also emerged. Title V of H.R. 3 (as passed by the House) would enact the Education and Training for American Competitiveness Act of 1987, with provisions ranging from grants for literacy improvement to programs for teacher training and graduate education. S. 406, as introduced in January 1987, would authorize $100 million for special State grants under the Perkins Act. Other bills propose tax credits for company-run programs that go beyond training the employer would provide anyway. As Option 20 suggests, the prerequisite for more extensive adult education and training seems to be money, not ideas.

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[22] *Technology and Structural Unemployment: Reemploying Displaced Adults*, op. cit., ch. 2.

In addition to programs like those outlined above, the Federal Government has permitted employees to deduct expenses for education directly related to their current job, and to omit from taxable income qualifying educational benefits provided by their employer. The 1986 Tax Reform Act (Public Law 99-514) retains the second of these provisions only through 1987; it will need to be reauthorized if it is to apply in later years.

Vocational and Paraprofessional Education and Training

For many jobs where a high school degree once sufficed, companies now seek entry-level people with specialized training (chs. 7 and 8). But where technical change is rapid, as it is in many of the knowledge-based service industries, training can quickly become obsolete. Absent shifts in public policy that would encourage companies to provide more training or pay a greater share of the costs, heavy burdens will continue to fall on individuals and on community colleges and vocational-technical schools.

Occupational titles for the knowledge-based services—customer service representative, data gatekeeper, para-legal or para-tax accountant (table 43, ch. 8)—suggest the kinds of generic skills needed:

- generalized troubleshooting and problem-solving;
- planning under conditions of limited resources and uncertainty;
- the interpersonal process in sales;
- negotiation and complaint encounters;
- retrieving, formatting, and analyzing data.

Programs including such training might or might not entail an extra span of coursework. It should be possible to do without some more-specialized courses, keeping programs to current lengths, if generalized approaches to skill development prove successful, and if employers could be encouraged to take care of narrower training needs themselves. Graduates of 2-year colleges and technical schools that offer broadly-based vocational curricula imparting the kinds of skills listed above should be better prepared to avoid obsolescence.

Much as for adult education and training, pilot and demonstration projects could help explore the merits of new and more general vocational curricula. Such projects should include, not only curriculum development, but evaluation and dissemination of results. Demonstration grants, with the active involvement of both the Departments of Education and Labor, should probably be contingent on participation by business and industry. Participation by organized labor would also be desirable. Congress could direct the Administration to proceed with this alternative as a cooperative demonstration program under one of the special grant provisions of the Perkins Act (Option 21).

Instructional Technology

Productivity in teaching and training has changed little over the years. Educational technologies hold great potential—as yet mostly unrealized—for improving both the effectiveness and the productivity of instruction, of nearly all kinds and at nearly all levels.[23] This section focuses on two specific issues: 1) transfer of training technologies developed with government support; and 2) the Federal role in development and dissemination of new instructional technologies.

Transfer of Training Technologies

Federal agencies, notably the Department of Defense (DoD), fund the development of a wide range of instructional materials and technologies. Because military systems have grown so complex—and because repair and maintenance personnel turn over relatively quickly—DoD has sought to develop computer-based teaching methods. The Army, for example, plans to spend $27 million over the period 1984-1990 on interactive videodisc training materials (and another $100 million on hardware). Other agencies, especially the Department of Education and the National Science Foundation (NSF), also support R&D on instructional technologies.

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[23] *Informational Technology and Its Impact on American Education* (Washington, DC: Office of Technology Assessment, November 1982) examines instructional technologies in primary and secondary schooling. *Technology and Structural Unemployment: Reemploying Displaced Adults*, op. cit., covers adult education and training. The discussion below draws on pp. 96-101 and pp. 299-302 of the latter report, updating its findings. OTA is presently conducting an assessment entitled "Educational Technology: An Assessment of Practice and Potential."

While some of the training materials developed by DoD to meet its own needs might be quite useful to the public education system, or to private industry, mechanisms for evaluating and transferring these materials have proven less than adequate. Federal agencies seldom address such questions as: Which course materials are relevant to education and training outside the government? What modification would be needed? Nor have Federal agencies made the instructional materials themselves easily available for others to try out.

Congress has called for a first step, in the Federal Technology Transfer Act of 1986 (Public Law 99-502), which directed the Secretary of Commerce to submit a report on legal barriers to transferring Federally-funded computer software, and on the feasibility and costs of compiling a comprehensive inventory of Federally-funded training software (Option 22). (Public Law 99-502, one of two bills enacted in the 99th Congress which amended the Stevenson-Wydler Technology Innovation Act of 1980, gets further discussion in the section below on technology policy.)

A more ambitious approach, in Title V of the House-passed version of H.R. 3 (sections entitled "Transfer of Education and Training Software"), would create an office in the Department of Education to transfer course materials to State and local agencies, and to the private sector. Another proposal in the 100th Congress, S. 406, would (as introduced) place a training technology transfer office in the Department of Commerce. Alternatively, it would be possible to rely on existing technology transfer mechanisms, rather than setting up a new office; Congress could, for example, direct Federal agencies that have established offices of research and technology application—charged under the Stevenson-Wydler Act with technology transfer—to devote part of their effort to training technologies and materials (Option 23).

Research, Development, Evaluation, and Dissemination

Over the longer term, realizing the potential of new instructional technologies will require continuing research on learning, as well as the development of better instructional techniques and teaching materials. Teachers will themselves have to be retrained, as recently stressed by the National Task Force on Educational Technology.[24] Although the task force focused on the public schools, a number of its recommendations are equally appropriate for adult education:

- develop a long-term Federal Government R&D agenda for instructional technologies, in collaboration with school officials and the information industry;
- designate a highly visible and widely respected Federal agency to support peer-reviewed R&D on the application of information technologies to education;
- support State centers for evaluating and implementing computer-based instructional technologies.

Computer-based systems create opportunities for radically different approaches to education at all levels—opportunities that have been anticipated for years, and that may finally be nearing fruition. Taking full advantage will require Federal R&D support—including evaluations of the effectiveness of new methods, and programs for disseminating results and training teachers in the use of new instructional techniques and teaching materials. Federal research funds appear particularly critical for adult education, which has received little attention in the past.

Congress, in Title I of the Higher Education Amendments of 1986 (Public Law 99-498) called for establishment of a national program of research on adult learning. However, it stipulated that no money be appropriated during fiscal years 1987-91. Meanwhile, funding for educational laboratories and centers administered by the Department of Education's Office of Educational Research and Improvement (OERI) has remained at the $30 million level since fiscal year 1974. The Department also supports research through other programs, but OERI (formerly the National Institute of Education) is the largest. Given that R&D on instructional technologies must compete with other needs, many of them well-established, adequate exploration of new approaches to teaching and training based on new technologies will probably require a substantial boost in support (Option 24).

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[24] *Transforming American Education: Reducing the Risk to the Nation*, A Report to the Secretary of Education by the National Task Force on Educational Technology (Washington, DC: Office of Educational Research and Improvement, Department of Education, April 1986), p. 24.

INDUSTRIAL AND TECHNOLOGY POLICIES

Competitiveness depends on technological innovation, among other things, and innovation depends on R&D and the technology/science base (again, among other things). Certainly true for manufacturing industries, does this causal chain hold for the services? From the evidence presented in the sector chapters, the answer is yes. Not only do the service industries depend on much the same technology/science base as manufacturing, but services and manufacturing depend on one another in many ways; technology policy should be seen from a vantage point encompassing both.

As discussed in chapter 9, governments encourage R&D and technology development both directly and indirectly. Some place more emphasis on commercial technologies than does the United States. In a few countries—notably Japan—government appears to have a deeper appreciation of the ways in which the knowledge-based services, in particular, can stimulate economic growth. This section begins with the need for better understanding of R&D in the service industries, and goes on to the U.S. environment for technological innovation and diffusion of commercial technologies—a subject that OTA treats quite broadly, in part because the analysis of technical licensing patterns in chapter 6 reveals cause for concern in the Nation's technology infrastructure as a whole.

R&D in the Services

As pointed out in box FF in the preceding chapter, Federal Government statistics greatly understate the contribution of services to total U.S. R&D spending. *Science Indicators*, the principal government compilation of R&D data, suggests that nonmanufacturing industries account for a bit over $2 billion in annual spending—less than 3 percent of all U.S. industrial R&D. This is far below the alternative estimate for services-related R&D in table 48 (ch. 9)—about $26 billion, one-quarter of U.S. industrial R&D. Such a figure—while a rough approximation—demonstrates that R&D in the services has been much more important than commonly appreciated. Services-related expenditures have been under-reported for largely historical reasons (including definitions oriented toward manufacturing); but with technology development by U.S. service suppliers exceeding the total R&D budgets of most countries—and with some of the money coming from Federal sources—policymakers plainly deserve better information (Option 25, table 61).

Research, Development, and Diffusion of Commercial Technologies

This and other OTA assessments have pointed to the need for more systematic attention to commercial technologies in the United States—to the technology base itself, and also to mechanisms for diffusing existing knowledge to firms that need it. Few companies have the resources—people as well as dollars—to learn everything they need to know on their own. By helping companies move from research to commercial production more quickly, greater Federal support for pre-competitive technology development could strengthen U.S. competitiveness in emerging fields such as information services and biotechnology; in mature industries, it could help improve productivity and manufacturing efficiency. Because the technology and science base for service industries overlaps that for manufacturing, Federal policies aimed at reversing the decline in U.S. technological advantage would help the services quite directly.

Beyond mission-oriented R&D directed at needs such as national defense and health care, the Federal Government funds basic research—

Table 61.—Issue Area IV: Technology Development

Issue	Options for Congress	Comments
A. R&D IN THE SERVICES OTA finds U.S. R&D related to services to be much greater than reported in the usual Federal Government data series. Better information would make for better R&D policy choices.	OPTION 25: Direct Federal agencies—specifically, the National Science Foundation—to develop new criteria for identifying and collecting information on R&D and technology development related to the services.	Technology development in the services seldom fits very comfortably into traditional views of R&D. Services R&D has been underreported for reasons similar to those for the underreporting of services trade in the U.S. current account—outdated and unexamined procedures, many of which simply omit service activities.
B. THE U.S. TECHNOLOGY BASE The services depend on much the same technology base as manufacturing. Leaving aside national defense, the Federal Government provides relatively little funding for technology development.	OPTION 26: Increase Federal R&D support for commercial (i.e., non-defense) technologies by expanding initiatives such as NSF's Engineering Research Centers, and ensuring continued funding for existing programs such as the Center for Building Technology at the National Bureau of Standards.	In addition to the 11 existing ERCs, NSF has funded two new centers starting in fiscal year 1987; one more is under consideration for this year.
Congress has called for more emphasis on diffusion of technology to American industry through such laws as the Stevenson-Wydler Act (Public Law 96-480). The Administration, however, has only implemented parts of the legislation.	OPTION 27: Alternatively or in addition to the steps in Option 26, Congress could, under the 1986 Federal Technology Transfer Act (the 1986 amendments to Public Law 96-480), authorize, provide funding for, and direct the Administration to offer grants for Centers for Cooperative Research. For greatest effectiveness, these centers should be charged with technology diffusion as well as development.	Should Congress choose to create an Advanced Civilian Technology Agency or National Technology Foundation—as has been proposed in a number of bills introduced in recent years (e.g., S. 1233 in the 100th Congress)—cooperative technology centers would fit naturally into its role and function. Technology diffusion programs could be cost-shared between the States and the Federal Government.
The United States, no longer the unquestioned leader in technical knowledge, will need to do a better job of learning from foreign technology in years to come. This may entail devoting more resources to locating, evaluating, and translating foreign technical literature, encouraging more U.S. participation in overseas R&D, and seeking reductions in barriers that impede access to foreign technologies.	OPTION 28: Emphasize congressional commitment to implementation of the Japanese Technical Literature Act of 1986 (Public Law 99-382) through early oversight and full funding. If Congress wishes to place more emphasis on screening and evaluation, or to direct the Administration to fund translations of interest to university-based researchers, it could direct the Commerce Department to share responsibility with agencies having more experience in technology and science—e.g., the National Science Foundation.	The Commerce Department, which is already spending $1.8 million on related tasks, plans to implement the law by reprogramming $300,000 from its existing budget.
	OPTION 29: Increase support for exchanges of U.S. technical personnel with those of other nations. Congress could fund fellowships that would send graduate students in engineering to countries like Japan, as well as considering programs that would provide partial support, in conjunction with employers, for industrial engineers and scientists working abroad temporarily (in industry or in universities).	Sending more engineers and scientists to work temporarily abroad could help change corporate attitudes in the United States, and would give American industry more rapid access to foreign technologies as they emerge. To maximize the value of such programs, those awarded fellowships should get language training—e.g., in Japanese—before going overseas.
	OPTION 30: Make equitable access to foreign technology a formal U.S. negotiating objective, and call for reductions in restrictions on access for U.S. citizens to publicly-supported R&D projects in other countries.	Pursuit of this objective (included in H.R. 3 as passed by the House in May 1987) would need to be consistent with U.S. policies on foreign access to results from government-supported R&D projects here.
Policy adjustments may be needed to capitalize on the potential of defense spending for enhancing the competitiveness of commercial industries. While such issues have been raised in the past, not enough is known to guide policy development.	OPTION 31: Investigate and evaluate policies for maximizing the positive impacts of defense-related R&D and procurement on the international competitiveness of American industries.	Analysis of the linkages between the military and civilian sides of the economy might also lead to policy changes making it easier to adapt commercial technologies to military systems.

Table 61.—Issue Area IV: Technology Development—Continued

Issue	Options for Congress	Comments
C. TECHNICAL STANDARDS		
Before the AT&T breakup, a single company dominated the process of setting technical standards. Today, the process involves many firms in competition with one another. Because implementation of ISDN (Integrated Services Digital Networks) will involve multiple actors, finding ways to minimize incompatibilities among different systems—and the associated costs to users—takes on new significance.	OPTION 32: Direct the National Bureau of Standards (in cooperation with the National Telecommunications and Information Administration) to set up an ISDN testing and demonstration laboratory to help government agencies make purchasing decisions and take advantage of emerging technical capabilities, and to help pave the way for a smooth transition to ISDN in the United States.	NBS's Institute for Computer Sciences and Technology already has related work underway on OSI (Open Systems Interconnection). An ISDN laboratory could provide independent assessments to support Federal procurement decisions, and also disseminate information to private sector users of telecommunications services. If industry were willing to donate equipment, Federal funding for the laboratory could be kept modest.
Developing U.S. positions at the ITU has become far more complex since the AT&T breakup. Future ITU deliberations may well define a global framework for ISDN, with impacts on equipment sales as well as services. U.S. positions at the ITU and at other forums (e.g., GATT) will need to be carefully worked out and coordinated.	OPTION 33: Congress could anticipate the possibility that incompatible standards for ISDN will be proposed both internationally and within the United States, and begin to take preparatory steps to address such issues. Specific actions might include: • oversight to review U.S. preparations and negotiating positions for upcoming ITU meetings (e.g., WATTC-88), and the implications for U.S. positions at GATT and in other trade negotiations dealing with telecommunications; • request of a comprehensive study to review prospective ISDN standards and implementation, with a view to laying groundwork for future policy decisions (e.g., if it appears that U.S. telecommunications carriers might adopt dissimilar approaches that would be costly for users).	The State Department coordinates and presents U.S. positions at the ITU. The Department relies heavily on the private sector, through committees, for advice on U.S. recommendations concerned with standards. The State Department is also at work on the U.S. position for the 1988 World Administrative Telephone and Telegraph Conference—the first WATTC since the AT&T breakup—and the plenipotentiary ITU meeting scheduled for 1989.

SOURCE: Office of Technology Assessment, 1987.

much of it through NSF, and mostly in universities. But government agencies have preferred to stay out of technology development related to commercial products and processes. Civilian applications do follow quite directly from some Federal spending. Defense-related R&D and procurement stimulated the early growth of the U.S. computer and semiconductor industries. Basic research funded by the National Institutes of Health helped fuel the take-off of the biotechnology industry. But these are the exceptions.

The Reagan Administration has held that support for basic research should suffice to rebuild the Nation's technological competitiveness. OTA's analysis indicates that judicious support for generic or pre-competitive technologies—those that can be applied by all companies in a given industry (or making use of a given field of knowledge)—would also pay off. Where the benefits to any one firm tend to be indirect and elusive, companies have little incentive to invest. But much as for basic research, the social benefits can be considerable. The analysis in chapter 4, for example, indicated that Federal R&D funding for construction technologies—where companies traditionally have conducted little R&D on their own—would have benefits both domestically and internationally. A second example: R&D aimed at improving productivity in the design and development of computer software (ch. 5). Progress here would help not only the software industry, but computer hardware manufacturers, companies that embed machine intelligence in their products, and, indeed, software users throughout the Nation's economy. But at present, only a few large companies conduct much research on software productivity.

In recent years, Congress has taken steps to stimulate R&D and technology development both indirectly and directly. R&D tax credits have been the primary indirect instrument. Unfortunately, for reasons explored in box HH, tax credits are seldom very effective in encouraging firms to undertake R&D they would

Box HH.—The R&D Tax Credit

Prior to 1981, the major U.S. tax incentive for research, Section 174 of the tax code, permitted firms to deduct qualifying R&D expenditures as current expenses. With the inclusion of a Research and Experimentation Tax Credit as part of the Economic Recovery Tax Act of 1981, companies could take a credit equal to 25 percent of the incremental amount of qualifying expenditures over and above their average R&D spending for the three previous years. The intent was to raise incentives for R&D, stimulating innovation and strengthening U.S. competitiveness. The 1986 Tax Reform Act (Public Law 99-514, Subtitle D of Title III) extended the R&D tax credit through 1988 at the reduced level of 20 percent.

How effective has the credit been? While many nations provide such tax incentives, here as elsewhere most of the evidence indicates that they have relatively minor effects on levels of industrial R&D spending.[1] Industry strongly supports the credit—which has cut corporate tax bills by about $1.5 billion annually—but most of the empirical studies have found that the financial benefits of the tax credit have not been great enough to influence corporate decisions on R&D very much. Reducing the tax credit from 25 to 20 percent has weakened incentives further.

Over the longer term, R&D tax credits at either 20 or 25 percent may contribute to somewhat greater spending by U.S. industry, services included. But the fundamental question is whether this is an efficient way to stimulate industrial R&D. According to OTA's analysis, it probably is not. Past OTA assessments have consistently indicated that gaps in R&D exist, and that they contribute to competitive difficulties. But the problem is as much one of allocations of R&D dollars as of the overall level of spending. There is no reason to expect R&D tax credits to have much effect in raising priorities for projects that would help fill these gaps. At the same time, an R&D credit that attempted to target particular research needs would be difficult to administer.

While the 1986 tax act temporarily extends the credit, many service firms get little benefit because their R&D projects are viewed as too close to marketing (the 1986 bill does make many development expenditures for computer software eligible for the first time). If Congress decides to retain the R&D tax credit, it might direct the Treasury Department, in cooperation with other agencies, to draft new rules that would accommodate a broader range of the technology development projects found in the services. So long as the credit remains in effect, there is no reason not to treat service firms comparably to those in manufacturing.

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[1] *Research and Experimentation Tax Credit*, hearings, Subcommittee on Oversight, Committee on Ways and Means, U.S. House of Representatives, Aug. 2-3, 1984 (Washington, DC: U.S. Government Printing Office) (especially the testimony of E. Mansfield, p. 142). Also, E. Mansfield, "The R&D Tax Credit and Other Technology Policy Issues," *AEA Papers and Proceedings*, vol. 76, May 1986, p. 190; "The Research Credit is a Limp Stimulant to Corporate Spending," *Wall Street Journal*, Jan. 8, 1986, p. 1.

not otherwise pursue. In perhaps its most important direct measure, Congress authorized a more active Federal role in supporting commercial technologies when it passed the Stevenson-Wydler Technology Innovation Act of 1980 (Public Law 96-480)—a law the executive branch has implemented only selectively.

In 1983, the Reagan Administration revoked the rules covering grants for industrial technology centers authorized by the Stevenson-Wydler Act, substituting a Commerce Department initiative which supplies information intended to inspire firms to band together in R&D joint ventures.[25] Although current antitrust policy also favors joint ventures for pre-competitive R&D (ch. 6), industry response, with few exceptions, has been tepid. The reasons seem plain enough: on their own, companies that normally compete will cooperate only on quite visible, indeed obvious, research problems—those they can agree on and hope to solve relatively quickly. The centers envisioned in the Stevenson-Wydler Act would have addressed this quite predictable feature of the technological landscape through government-industry-university partnerships, with the expectation that much of the leadership would emerge from the university research community. Perhaps the greatest shortcoming of the Act as originally passed was that it called for the centers to eventually become self-supporting. Past analysis by OTA suggests that continued cost-sharing by the Federal Government would not only provide stability, but extend the R&D time horizons beyond those of the private sector.[26]

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[25] *Federal Register*, vol. 48, No. 223, Nov. 17, 1983, p. 52289. In 1986, with the passage of the the Federal Technology Transfer Act of 1986 (Public Law 99-502), Congress amended the Stevenson-Wydler Act to encourage cooperation between Federal laboratories and the private sector. The Commerce Department's authority to provide grants for industrial technology centers has lapsed, but even so the 1986 amendments changed the name to cooperative research centers. Congress could, of course, reauthorize such grants at a later date.

The Reagan Administration has also proposed to eliminate, consolidate, or scale back existing programs that conduct generic R&D and technology development, such as the Center for Building Technology at the National Bureau of Standards (ch. 4).

Recently, the Administration has also created a program of Engineering Research Centers (ERCs), with funding from NSF, along with a DoD undertaking entitled University Research Initiatives (URI). The first two years of the ERC program saw 11 university centers established. Through fiscal year 1992, NSF proposes a $160 million commitment to the program (private sector sources also provide support); current plans call for a total of 25 centers by 1989. While the objectives include strengthened linkages between universities and industry, the ERCs are properly seen as centered on the universities. Nor is it likely that DoD's URI program will provide much immediate help on the civilian side of the economy; the program is still in its early stages, but it seems plain—and quite natural—that most of the support will go for technologies that DoD research managers view as necessary for meeting future mission requirements.[27]

NSF's ERC program plainly represents a step in the right direction. To encourage R&D that would strengthen the technology base for American industries, Congress could ensure continuing support for the ERCs, as well as existing programs for generic technology development (e.g., those at the National Bureau of Standards, NBS) (Options 26 and 27). Directing the Administration to fund centers as envisioned in the Stevenson-Wydler Act would help move university research agendas closer to the needs of industry. Support for programs that transferred R&D results to the private sector would enable American companies in many industries to compete more effectively. (As noted in ch. 4, more effective technology transfer mechanisms would help the E&C industry benefit from technologies developed through DoD funding for construction-related R&D, which totals about $270 million per year.)

Access to Foreign Technology

Given rough technological parity in many fields, American companies now have a good deal to learn from overseas. This will take new attitudes by corporate managers, but Federal policies can also contribute. In part because the United States has been ahead for so many years, both the public and the private sector have neglected mechanisms for locating, evaluating, and translating information on foreign scientific and technical developments. Congress has made a start on this problem, most recently with the passage of the Japanese Technical Literature Act of 1986 (Public Law 99-382, like the Federal Technology Transfer Act of 1986, an amendment to the Stevenson-Wydler Act). Among other things, this law directs the Commerce Department, through the National Technical Information Service, to monitor technical developments in Japan and consult with users on their needs for information concerning Japanese engineering and technology. Commerce is to translate Japanese publications (on a cost reimbursable basis) and prepare annual reports on scientific and technical developments in Japan.

Although a significant step, the new legislation goes only part way in meeting U.S. needs for foreign technical information (Options 28-30). Given the costs of translation, and the limited budgets of the Nation's universities, it seems logical that the Federal Government pay for translations covering the results of basic research—which will generally be of more interest to university than to corporate engineers and scientists. Beyond this, some foreign developments are much more significant than others: given huge quantities of information on foreign technology and science, it would be logical to develop screening procedures for identifying and evaluating the more important foreign work. Screening could benefit the government directly—e.g., through locating foreign technologies with potential applications in public works projects or military systems.

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[26] "Development and Diffusion of Commercial Technologies: Should the Federal Government Redefine Its Role?" staff memorandum, Office of Technology Assessment, Washington, DC, March 1984.

The short-term orientation of U.S. industrial R&D has been one cause of technology gaps. Industry cooperatives generally have time horizons somewhat longer than those of individual firms, but still relatively short—a problem the Commerce Department's information program does not address.

[27] See, for example, the list of research topics in "The Department of Defense FY 1986 University Research Initiative Program Overview," December 1985.

Personnel exchanges provide notably effective mechanisms for technology transfer, while also helping lay groundwork for long-term working relationships among researchers in different parts of the world. Many foreigners visit U.S. R&D installations, and many foreign nationals study at U.S. universities, but few Americans go abroad to conduct research. Among those who do, the language barrier means that only a tiny number go to Japan. This situation has begun to change, with new university programs that send American graduate students in engineering and science to work in Japanese laboratories. The U.S.-Israel Binational Industrial R&D Foundation also deserves mention, along with AID's Program for the Advancement of Commercial Technology. Federal support for the university programs could be particularly useful.

Finally, Congress could direct the Administration to seek increased access to foreign technology through the trade negotiations process. For example, H.R. 3, as passed by the House, would establish equitable access to foreign technology as a formal negotiating objective. In earlier years, barriers in foreign countries such as restrictions on technical licensing were of little concern, but now that other countries have strengthened their technological capabilities, it stands to reason that they be as open as the United States was in the past.

Military R&D; Federal Government Procurement

The U.S. Government played a crucial role in the rise of the information industries through research funding and purchases. Federal procurement and contracting policies have aided developments in software through standards for computer languages. Government purchases of services (and goods) can guarantee markets, reduce uncertainty, and stimulate growth. (See box II on the E&C industry.)

When it comes to more recent programs—e.g., DoD's Strategic Defense Initiative (SDI), and its Strategic Computing effort—Congress could seek to identify and implement policies aimed at maximizing favorable impacts on the civilian economy. Despite a great deal of rhetoric concerning the spinoffs from military spending (and space), remarkably little is known about the interactions and possible trade-offs between defense R&D (and procurement) and international competitiveness. Thus policy guidance would seem to demand, as a first step, a reopening of a fundamental set of questions in technology policy (Option 31)—questions that include:

- *How* do procurement and R&D expenditures by DoD (and the National Aeronautics and Space Administration) affect the development of civilian, commercial technologies—not only through the products and processes that emerge, but through contributions to technical knowledge and engineering design/analysis procedures?
- How has Federal spending benefited commercial industries (e.g., information services) in *recent* years? What, specifically, are the probable spinoffs from SDI? Will the most important of these be engineering methods or products/processes themselves?
- What is the *balance of benefits and costs* from technology development aimed at defense and space? Do military and space programs claim the best and the brightest among American engineers and scientists, weakening civilian industries?

Box II.—Federal Procurement of Engineering and Construction Services

Buy-American preferences and set-asides ensure a good deal of overseas work for U.S. E&C firms. In 1983, Congress amended the Foreign Service Buildings Act (Public Law 98-164, Sec. 136) to give a 10 percent bidding preference to American companies—and also to foreign firms whose governments extend reciprocal preferences to U.S. contractors. The measure, intended to open up bidding processes in other countries as much as to aid American E&C firms, applies to projects costing $5 million or more. Similarly, Section 116 of the Military Construction Appropriation Act, 1986 (Public Law 99-173), required that all contracts for military construction in NATO countries and Japan valued at greater than $1 million go to American companies.[1] The Omnibus Diplomatic Security and Antiterrorism Act of 1986 (Public Law 99-399), which authorizes $2.5 billion through fiscal year 1990 to improve security abroad, could prove a substantial boon for U.S. firms. The embassy security program restricts contracts of more than $5 million to American contractors, or majority joint ventures. The law also provides for small-business set-asides.

Although Congress could further expand preferences and set-asides on U.S.-funded construction projects in foreign countries, such steps—while providing assistance to an American industry experiencing competitive difficulties—would generally mean higher costs for the taxpayer (leaving aside cases like that of the new Moscow embassy). Moreover, diplomatic considerations and existing agreements will often limit such preferences. Both the embassy security program and the Foreign Service Buildings Act exempt projects in countries where current policies bar U.S. contractors, while the Foreign Service Buildings Act gives the Secretary of State latitude "in the interest of bilateral relations." But the most significant drawback to such policies is simply that bidding preferences fail to address the fundamental competitive weaknesses of U.S.-based E&C firms. They would do little to improve competitiveness beyond providing financial support, unless coupled with other steps that helped the industry improve its competitive position—i.e., programs for technology development.

As chapter 4 points out, innovation in the U.S. construction industry has been slow. Federal procurement policies that worked to encourage innovation could contribute to strengthening the industry's international competitiveness. Congress might direct Federal agencies to experiment with performance-based contracting procedures, rather than rigid specifications that discourage use of new construction methods.

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[1] Joint ventures with host nation firms are permitted. The appropriations act for fiscal year 1987 (Public Law 99-591) lowered the threshold to $500,000, while also giving American contractors a 20 percent cost preference for military construction projects on Kwajalein Island, in U.S. territories such as Guam, and for military dredging operations in the Indian Ocean.

Congress has also looked to the Defense Department for indirect support of U.S. E&C exports. In 1984, Congress instructed DoD to designate an ombudsman to help U.S. firms get contracts for NATO-funded projects in Europe, and to require that all NATO-approved projects over $5 million be advertised in the *Commerce Business Daily*—House Conference Report 98-1159, to accompany H.J. Res. 648 (Public Law 98-473), Continuing Appropriations for fiscal year 1985. Language in House Report 99-648, to accompany H.R. 5052, Military Construction Appropriations Bill, 1987, increases the threshold to $15 million. While about 50 U.S. firms have been certified to compete for NATO projects, the first 16 months of the program saw only one bid, and that unsuccessful—"U.S. Contractor Participation in Overseas NATO Construction," fact sheet prepared by W.L. Harper, Office of the Assistant Secretary of Defense/Acquisition and Logistics, Department of Defense, 1986.

Although some in the E&C industry have argued that the government should routinely reserve construction paid for by the United States in non-NATO countries for American contractors, other policy considerations work against this. Many military basing agreements, for example, require that contracts go to host country firms.

- Given that the United States will continue to spend large sums on defense-related technologies, how can the *positive* impacts on the civilian economy be maximized? How can the United States speed the transfer and adaptation of military technologies to commercial industries?

Technical Standards

Standards sometimes become non-tariff barriers (ch. 9). On the other hand, they can also contribute to stable and predictable market conditions, and thus to the spread of new technologies. As mentioned earlier in this chapter, in

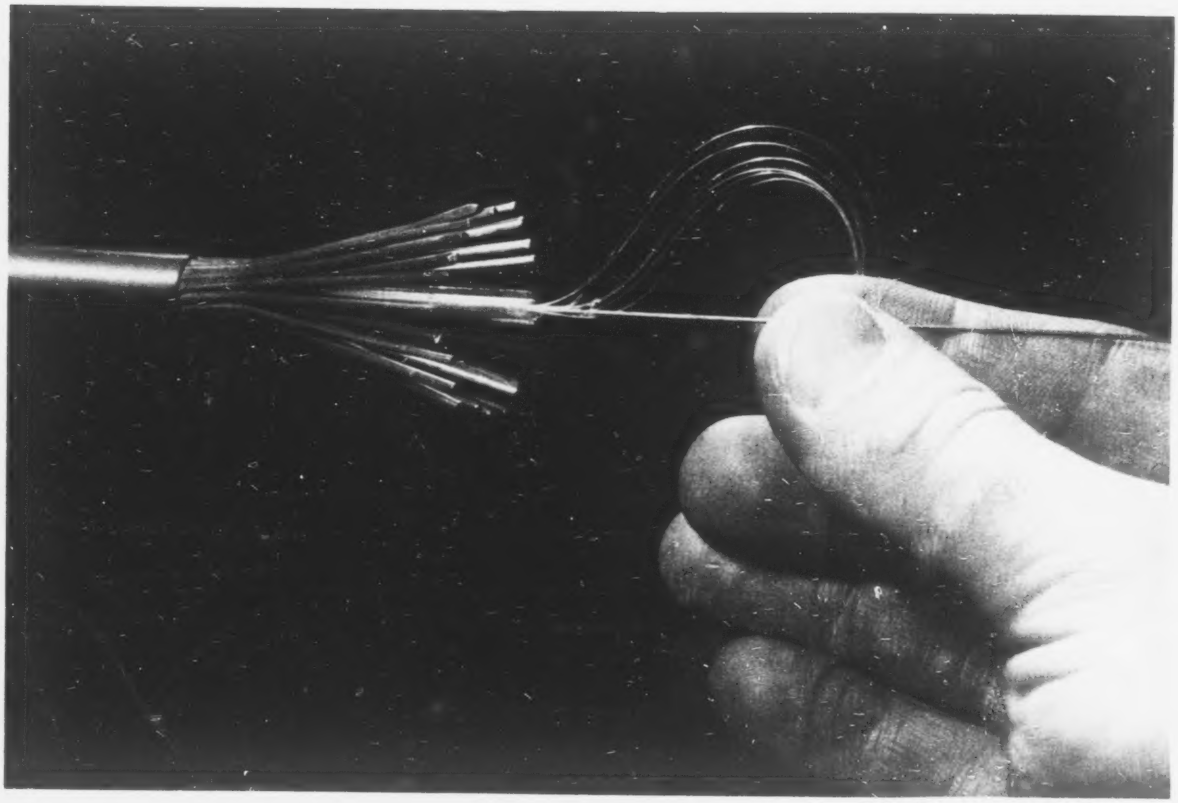

Photo credit: AT&T Bell Laboratories

Optical fibers for telecommunications

the section on telecommunications, an important set of questions revolves around future standards for ISDN. Open Systems Interconnection (OSI) standards for computers—a related matter—have also surfaced in international discussions.

In terms of domestic U.S. policies, the primary concern—partly one of standards, partly regulatory—lies in the implications of the AT&T breakup for compatibility in the Nation's telecommunications infrastructure. In the newly competitive environment, technical standards might easily become a weapon for companies seeking an advantage over their rivals. Is it possible that the regional holding companies (RHCs) will seek to introduce differing and incompatible ISDN standards as a shield against external competition? If so, the costs to users of services provided over the telecommunications infrastructure could be high. Questions of technical standards also remain for videotext/teletext services. While the United States has national videotex standards in place, these may need revision as computer-based videotex systems supplant services supplied through television broadcasting. Again, it seems desirable to ensure that the RHCs do not implement incompatible standards—especially since they may eventually be allowed to expand their role in delivering such services.

Regardless of outcomes in the United States, setting international ISDN standards promises to be contentious. A complex institutional structure exists to define and recommend international telecommunications standards, centering on the ITU (more specifically, the CCITT).

The EC, which evidently plans to seek early CCITT agreement on ISDN standards favored by Community members, set forth a working program at the end of 1986. Intended as a step toward Community-wide standards, the eventual aim is no doubt to establish competitive advantages for European telecommunications firms as equipment markets emerge.

In the United States, standards-setting processes have become more complex with the end of the unified Bell System. USTR has recently established an expert group on ISDN in conjunction with the EC. Two private organizations, the American National Standards Institute (ANSI) and the Exchange Carriers Standards Association (ECSA, created in 1983 to develop common technical standards for U.S. telephone companies) have also turned their attention to ISDN. In preparations for meetings of the ITU and the World Administrative Telephone and Telegraph Conference scheduled for 1988 and 1989 (WATTC, ch. 9), the State Department and other Federal agencies will rely heavily on ANSI and ESCA.

The U.S. Government—the world's largest consumer of telecommunications, computer, and data processing services—has a direct stake in the evolution of ISDN. Procurement decisions by DoD and the General Services Administration (GSA), the two major government purchasers of telecommunications and related services, will help shape ISDN standards. Both agencies are currently evaluating their needs, and examining possible evolutionary paths to ISDN. GSA plans to replace the government's private intercity telephone network (called FTS) with commercial services under its FTS 2000 proposal.[28] Meanwhile, the Defense Communications Agency is seeking to determine whether ISDN standards driven by civilian needs would also satisfy military requirements.

Given the many actors already on the scene—and bearing in mind that the RHCs may eventually be permitted to engage in equipment manufacturing—there seem good reasons for a strong Federal role in steering ISDN choices so as to minimize incompatibilities. As one alternative, Congress could appropriate funds for an ISDN demonstration laboratory and testing facility, perhaps at NBS (Option 32). In any case, Congress may want to stay abreast of the evolution of ISDN, both internationally and in the United States—e.g., by directing appropriate Federal agencies to monitor and analyze ongoing technical developments here and abroad. With total expenditures on ISDN expected to run to many billions of dollars, policy conflicts are bound to arise. These could range from trade friction involving sales of equipment to a possible renewal of concern over TBDF restrictions. As stressed in chapter 9, technical matters that once could be left to specialists have now become important policy matters—for the United States and for our trading partners (Option 33).

ORGANIZATION AND EFFECTIVENESS OF FEDERAL POLICYMAKING

USTR has set the stage for negotiations on services in GATT. Getting results, in the Uruguay Round and bilaterally, will require that other agencies be brought fully into the process, along with parties whose interests will be affected by the outcomes. Priorities will have to be set, and the inevitable trade-offs managed. It seems clear that mechanisms for drawing in representatives of both labor and business will need to be strengthened. As the experiences of the Kennedy and Tokyo Rounds demonstrate, a politically acceptable agreement depends on a domestic political consensus built and maintained during the negotiations process; attempts to put such a consensus together later risk failure, as the Kennedy Round showed.

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[28] "FTS 2000 Services: A Request for Proposals To Replace the Federal Telecommunications System," second draft—October 1986, GSA DC-8911700203, General Services Administration, Washington, DC. GSA expects to let a 10-year FTS-2000 contract in 1988, with the new services—to include voice, data, and video—migrating to ISDN and conforming with national and international standards as they develop.

Recognition of the many links between domestic industrial (and technology) policies and trade has come relatively slowly in the United States. The policymaking process is still adjusting, as reflected in the hundreds of bills introduced in Congress over the past few years concerned in some way with problems of competitiveness, trade, and structural adjustment. Some of the proposals have dealt with a perceived need for greater coordination and integration in the Nation's policymaking system—institutions and mechanisms better attuned to the realities of international competition and the changing U.S. place in the world economy. But if recognition of the need has been growing, agreement on specifics seems only a little closer. This is evident in the diverse approaches proposed in the 99th Congress (and thus far in the 100th)—proposals that included, among others, bills to strengthen USTR, to create a White House council on trade, to establish an independent council on industrial competitiveness, to reorganize agencies with trade-related functions into a new department of trade. There have also been proposals for a department of science and technology.

Policy outcomes always depend to some extent on organizational forms; in exceptional cases, the structure of government will determine the course of policy debates because of the way information is channeled and decisionmaking authority distributed. But in the United States, the built-in dispersion of authority guarantees conflicts and ambiguity—as well as access for interested parties. The structure lets debate sprawl, rather than channeling it. More than 30 government bodies—ranging from Cabinet councils to line and regulatory agencies to special commissions—have significant policy influence when it comes to the service industries. Predictably, coordination is occasional.

Congress passed the International Trade and Investment Act of 1984 (Title III of Public Law 98-573, referred to earlier) partly to strengthen policy coordination. The Act gives both USTR and Commerce major responsibilities. With change in such matters always slow, it is not clear at this point how well inter-agency coordination is working. Nor is it clear how well the Department of Commerce will be able to fulfill its new responsibilities for analysis of competitiveness in the service industries, and for policy development; these have not been Commerce's strengths in the past.

Accompanying the calls for better coordination have been periodic proposals for trade reorganization. Those who advocate reorganization believe the fragmentation of responsibility in matters concerned with trade has gone too far, and that seeking better coordination among existing agencies is a vain hope; indeed, some might say that, should efforts at coordination lead to another administrative layer, the cure could be worse than the disease. The most common reorganization plans would create a department of trade (or department of trade and industry). Many bills proposed but not acted on in the 99th Congress called for some variant of the trade department theme. Most would move USTR and at least some parts of Commerce into a new department, perhaps joined by elements of other agencies. Those favoring reorganization believe such a step would help integrate trade-related policies at higher levels of the Administration, placing the new department's secretary in a position to deal with issues of both domestic and foreign economic policy—while also helping with the problems of an overloaded USTR, which must rely on other agencies for staff support.

The opponents of reorganization point out that a secretary of trade would be faced with a large department having numerous line responsibilities, entrenched operating procedures, and well-established political and bureaucratic relationships. Such an organization does not move quickly or easily. The secretary's room for maneuver would inevitably be limited; closeness to the president can counter such tendencies only so far. As those who look with disfavor on reorganization say, shuffling boxes on the organization chart won't accomplish much. Moreover, reorganization would be counterproductive if USTR—a small agency with a well-defined purpose and proven capabilities—loses some of its effectiveness. As a relatively elite group within the Federal Government, USTR has been able to attract outstanding employees—a major reason for its success. Finding and keeping good people might prove more of a problem in a larger, more cumbersome agency.

Although a plausible case can be made that creating a new department would reduce some of the overlap between USTR and Commerce, reorganization would have less effect when it comes to the many other agencies with a say in trade policy. The Departments of Agriculture and Defense, to take only the most obvious examples, would not quickly or easily cede influence over policies they view as important. Treasury jealously guards its macroeconomic responsibilities. As the number of trade complaints rises, the U.S. International Trade Commission becomes more influential in determining the Nation's de facto trade policy; the Commission is an independent agency. Nor is it likely that a trade department could (or should) take on functions now the province of the independent regulatory agencies (e.g., the FCC, the FRB)—so important when it comes to service industries.

The potential drawbacks to the reorganization plans, then, are many. Still, OTA's analysis suggests that—even given widespread agreement on policies at high levels in the executive branch—it may no longer be possible for the United States to develop and implement trade and foreign economic policies in consistent and coherent fashion. The international economy has changed radically over the past two decades; the structure of the U.S. Government has not kept up. Currently, the Administration may not have the analytical capability to develop sound policies, nor the tools to pursue them.

The problems have two fundamental dimensions—with prospective solutions that could be pursued independently or jointly:

- *analysis and decision support*—long-term planning, better institutional memory, and analytical guidance for trade-related decisions that Federal officials must now make on what is essentially a day-to-day basis;
- *policy integration*—mechanisms for developing broad consensus on overall policy objectives, and for managing the interagency process of policy implementation.

OTA addressed the first of these questions in the section above entitled "Trade Analysis and Information" (see Option 3 in table 56). Earlier portions of the chapter also discussed the need for coordination among Federal agencies.

When it comes to high-level policy development and integration—the second of these questions—there are a number of alternatives short of full-scale trade reorganization. The Reagan Administration has placed trade policy under the aegis of the Economic Policy Council, an informal cabinet-level group chaired by the Secretary of the Treasury. Other members of the EPC—which has no statutory basis—include the Secretaries of Commerce, Labor, Agriculture, and State, along with the U.S. Trade Representative and the Director of the Office of Management and Budget. In recent years, the Trade Policy Committee (TPC, an interagency group established under the Trade Expansion Act of 1962 and headed by the U.S. Trade Representative) has met only rarely, although its staff committees and subcommittees continue to function under USTR and EPC direction. Congress could direct the Administration to utilize the statutory TPC, rather than leaving trade policy subordinate to informal bodies like the EPC. Alternatively, Congress could replace or supplement the TPC with a new council on international trade within the Executive Office of the President, charged with formulating trade and foreign economic policy at the highest levels of the Administration.

Informal cabinet councils like the EPC have responsibilities that often shift over the course of an Administration, as well as between Administrations. If Congress were to create a statutory trade council, a president might or might not give it real authority. But the existence of such a council would provide a ready-made focal point for a chief executive who sought to implement a coherent trade policy. Legislation establishing such a council could symbolize congressional resolve to raise the priorities for trade policy to a level in keeping with its significance for the U.S. economy.

By itself, creation of a department of trade or a statutory trade council within the Executive Office of the President (or both) would do little to help the Nation's service (or manufacturing) industries maintain their competitiveness. Plainly, the effectiveness of a department or council would depend on how well the details were handled, and on how the president chose to proceed once the legislation had been passed. But given the growing importance of the service industries, Federal agencies with both domestic and trade responsibilities will, one way or another, have to redirect at least some of their activities over the next 10 or 15 years.

At many places in this report, OTA has stressed the interdependencies between services and manufacturing. This means that policymaking must also be integrated at some level between these two sides of the economy. If the 100th Congress decides to reorganize the trade functions of the government, it might build deliberate linkages into the legislative framework, not only between trade policies and domestic policies, but between policies affecting the services and those affecting manufacturing.

CONCLUDING REMARKS

Many of the policies that would help U.S. service industries maintain their international competitiveness could also help the Nation's manufacturing industries. American software and information services firms owe much of their competitive ability to a large installed base of computer hardware, to knowledgeable customers who have been aggressive in pursuing new computer applications, and to hardware manufacturers who have remained at the technological frontiers. In turn, good software helps sell U.S.-made computer systems. Government policies contributing to low entry barriers, abundant venture capital, and high employee mobility have helped spur the entrepreneurial vigor characterizing both software and information services in the United States. More broadly, advances in computer applications have helped many U.S. manufacturing companies improve their productivity and maintain their international competitiveness. And computer-based training methods hold out opportunities for teaching people how to learn, so that lifelong education can become a reality rather than a slogan. These are not the only examples: parallel if less far-reaching relationships hold between business services (advertising, accounting, management consulting) and their customers. Deregulation of domestic air travel has led to lower passenger fares, hence market expansion and new orders for airframe and engine manufacturers. Deregulation also helped open up international air travel, contributing to exports of American-made passenger jets.

The linkages between the services and manufacturing create a complex institutional challenge. Starting in the 1970s, the service industries made use of their access to the policymaking apparatus (nothing unusual for industries like banking or insurance, but new for the service sector as a whole) to help push GATT negotiations on services toward the top of the Nation's policy agenda—an effort arising in part from a feeling that policymakers had not been very responsive to the interests of the service side of the economy. Certainly the international ramifications of domestic policies have seldom received much consideration. But there is more than a question of responsiveness here: OTA's analysis suggests that it is the blurring of boundaries between services and manufacturing, rather than the special nature of services, that gives them much of their new importance. Still more broadly, recognition has grown that slackening international competitiveness—occuring more or less simultaneously in so many American industries—marks a real turning point in the U.S. position in the world. This has brought an intensified debate over trade policy. So far, the services have not had much prominence in the debate, but this may change—particularly if the Uruguay Round negotiations make rapid progress on their services track.

Many bills in recent Congresses have sought, in one way or another, a tougher negotiating stance vis a vis the Nation's trading partners. The ostensible premise has been that equalizing the rules of the game would help U.S. industry compete, and bring exports and imports into closer balance. Other legislative proposals, focusing on the domestic causes of declining U.S. competitiveness, have proposed changes in education and training, or in technology policy. Most of the bills reflect, in one way or another, tensions between two powerful forces:

- the tradition of U.S. leadership in advocating open markets internationally, and unfettered competition;
- dawning realization that American firms face real trouble in competing in those markets—markets that U.S. policies have helped create.

In the services, where U.S. competitiveness remains generally high, this tension has been less apparent than in manufacturing (although plain enough when it comes to the E&C industry); liberalization of trade and investment would help some (not all) U.S. service industries.

Agreements in GATT and elsewhere will not be easy to reach; many of the barriers in the services consist of domestic regulations that few governments regard as fair game for discussion and negotiation. Although the United States has partially deregulated a number of its service industries over the last 15 years, some regulation will plainly continue—to protect public health and safety (air travel), to safeguard consumers and investors (financial services).

In the past, Federal agencies have seldom taken much account of impacts on international competitiveness when pursuing regulatory or deregulatory goals—even when these impacts are quite direct. And indirect impacts are important too: government regulations not only constrain companies, they condition management decisions more subtly (e.g., through expectations concerning future regulatory actions). Moreover, the impacts of deregulation can be negative as well as positive. Relaxation of antitrust enforcement, for instance, if carried too far could threaten industries—including the majority of traded services—in which domestic competition has honed the international capabilities of American firms. This might seem a worry for the future more than the present. But it is certainly legitimate to ask if the U.S. semiconductor industry would have come into existence in anything like its current form if today's antitrust climate had been in place 30 years ago. The 1956 AT&T consent decree, which caused Bell Laboratories to diffuse its technology widely, shaped many aspects of an industry that remains a major source of technological and competitive strength for the United States, despite recent battering by the Japanese.

As many examples in this chapter have shown, with the U.S. economy increasingly integrated into the world economy, Federal Government decisions can no longer be viewed solely in a domestic context. Policymakers and regulators will have to pay more than sporadic attention to international competitiveness.

The United States finds itself remodeling its policymaking system when the need becomes great enough, pressures build to high levels. With realization growing that the U.S. position in the world economy has altered irrevocably from that of two or three decades ago comes a shift in the ways Federal agencies formulate and implement policy—a shift that is underway but far from complete.

For Congress, perhaps the next step is simply to seek enhanced visibility for the impacts on competitiveness of executive branch decision-making—to build international competitiveness into the policymaking process. Better data and analysis would help move things along. Congress could seek to strengthen the linkages between service industries and manufacturing through support for their common technology/science base; indeed, simply acknowledging that technology plays a critical role in maintaining a competitive group of service industries would be a start.

Coordination among Federal agencies will be an ever-present need, no matter the choices made by Congress. Jurisdictional disputes, traditions and habits—constants of the U.S. policymaking system—will not change overnight. But with time and accumulated experience, coordination between domestic regulatory policies and U.S. foreign economic policy should become somewhat easier. And Congress may decide the time is right to make more substantial changes in Federal policymaking structures. While ad hoc policymaking may have worked in the past, today—with shrinking or vanishing sources of advantage in global competition—the United States seems to need a new framework, as well as a new set of tools, for dealing with shifts in international competitiveness and their consequences.

APPENDIX 10A: EFFECTS OF TAX POLICY ON INTERNATIONAL COMPETITIVENESS IN THE SERVICES

Tax policies can affect competitiveness in many ways—for instance, by influencing the attractiveness of consumption relative to investment. Taxation also influences business decisions more directly; almost inevitably, investments in some economic sectors will be favored over others because of differing effective tax levels across the economy. Because international competitiveness depends on the outcomes of competitive rivalries *within* the economy, as well as those between U.S. and foreign firms (ch. 2), a micro-level view of taxation often proves most illuminating.

This appendix gives a number of brief examples drawn selectively from service sectors covered in earlier chapters. The examples highlight some of the provisions of the Tax Reform Act of 1986 (Public Law 99-514), a fundamental change in U.S. tax law, and one with impacts that will not be fully evident for several years.

Financial Services

Banks in the United States have typically paid far less of their income in taxes than companies in other industries—to some extent a quid pro quo for accepting lower rates of return on tax-free investments such as municipal bonds. But to the extent that low effective taxes (actual taxes paid divided by income) represent something other than compensation for lower returns before taxes on activities the government wishes to favor, favorable tax treatment has made the banking industry more attractive to investors. Indeed, low taxes have been one of the factors leading foreign banks to enter the U.S. market.

The 1986 tax act could substantially raise the taxes that banks pay. While the international effects will be indirect—none of the provisions directly change the taxation of foreign as opposed to domestic business—American banks may well be induced to emphasize fee-earning services relative to lending (a trend already well underway) because they will not be able to claim tax losses on loans as easily. In addition, a major source of income for banks—buying tax-exempt securities with borrowed money, the expense of which reduces taxes—will be largely eliminated. Finally, the Tax Reform Act, by eliminating the investment tax credit, may cut into revenues from the leasing businesses that many financial institutions have established.

With higher taxes, U.S. banks may lose some international business they might otherwise get on straight lending because they will have to increase their net interest margins slightly. Fewer safe profit-generating activities domestically means a narrowed range of strategic options internationally.

Engineering and Construction

Tax policies have long been a concern of U.S. E&C firms operating overseas, and their employees. The income taxes that Americans stationed abroad must pay influence the wage levels they expect, hence the costs to their employers. Furthermore, when U.S. E&C companies invest in foreign countries, they must generally pay taxes on their profits to both the U.S. Government and the host nation. The primary question has been the extent to which U.S. tax obligations will be reduced as a consequence of foreign tax payments.

For individuals, Section 911 of the Nation's tax code has excluded the first $80,000 of overseas wages from Federal income taxes. Although E&C companies, along with others that station Americans abroad, have argued for an increase in the level of exclusion, the 1986 tax act reduces it to $70,000. As a result, U.S. firms that send highly paid employees overseas—e.g., managers and engineers—will find themselves at a slightly greater labor cost disadvantage relative to many of their foreign competitors.

Other tax policies that affect the E&C industry include the levies on technical assistance that some countries impose. These are taxes on professional services produced outside the country but sold within its borders. In most cases, the cost of this tax is simply passed along to the client. Because it then appears as part of the E&C firm's revenues, the cost of the local tax itself is subject to U.S. taxes. Legislation proposed in the 99th Congress (H.R. 3494) would have permitted American companies to deduct or credit taxes paid to a foreign government on construction services carried out in the United States for an overseas project. This would probably not make much difference for competition. The E&C industry has been slow to take advantage of tax incentives that are already available for promoting exports. For instance, even though architectural and engineering services for foreign construction projects were specifically included in legislation establishing tax-sheltered Foreign Sales Corporations, E&C firms have yet to make use of this mechanism.

More favorable tax treatment of international E&C activities could help cash flow positions and profitability levels, and might marginally lower the bids that American firms enter on some projects. By themselves, however, changes in tax policy would not have much effect on the cost disadvantages U.S. E&C firms must contend with in many foreign markets.

Information Technology Services

Entrepreneurial startups have been responsible for much of the vigor in this sector. Venture capital supplies for startups depend, among other things, on tax treatment of capital gains. Because the 1986 Tax Reform Act raises effective capital gains tax rates, startups may become somewhat less attractive. It remains to be seen how great the impact will be, because other factors—primarily converging technological and market opportunities—have an even stronger influence on entrepreneurial industries.

A second tax issue—relating only to computer software—illustrates the sometimes circuitous routes through which taxation can affect competition. In the past, the Internal Revenue Service (IRS) has sought to treat software firms as passive holding companies when a large proportion of their revenues came from licensing. While the 1986 tax bill specifically exempts software firms from classification as passive holding companies, the example remains instructive. Some software suppliers choose to license their products, in both domestic and foreign markets, because other forms of protection for intellectual property rights fail to provide adequate protection (box GG, ch. 9). If a licensee makes illegal copies or otherwise breaks the agreement, the software firm can revoke the license. Revenues, however, come not from sales but from licensing fees. Because of this, the IRS had proposed to tax software firms as passive holding companies—subject to higher rates than active operating companies. Such a classification would have done considerable violence to the nature of this industry. Nonetheless, the IRS had threatened firms with bills for back taxes—as much as $30 million in one case.

Technical Licensing

Relative tax levels here and abroad affect decisions on exploiting proprietary technology—whether to produce at home and export or to license companies abroad, whether to negotiate licenses with unaffiliated firms or only with affiliates. Other things the same, a multinational will attempt to arrange its internal transactions to minimize tax liabilities on a global basis. International differences in taxation give MNCs many opportunities for doing so. At the most obvious level, royalties from unaffiliated firms will be taxed as income, whereas royalty flows from affiliates can be treated as intracorporate charges, exempt from taxation. Of course, the tax-collecting authorities of each country will attempt to ensure that they get their fair share--one reason for the tax treaties that governments negotiate with each other.

In the United States, the IRS requires that fees and royalties from intracorporate licensing approximate revenues that would be earned in arms-length transactions. U.S.-based multinationals are likewise expected to allocate R&D expenditures on a reasonable basis between the parent firm and foreign subsidiaries. This prevents companies from, say, loading all R&D costs onto the U.S. parent's income statement so as to lower domestic earnings and hence the firm's IRS bill. Other possibilities arise because U.S. law permits deferral of taxes on foreign earnings until the income is repatriated to the United States. In the absence of IRS rules governing allocations of expenses, MNCs would be tempted to transfer income to subsidiaries located in countries with low corporate tax rates—by, for instance, permitting their subsidiaries to use U.S.-developed technologies at no charge. After paying foreign taxes on income from the technology, the company could then repatriate the funds as untaxed capital flows. Existing tax laws are intended to prevent indirect transfers of this type, but it is hard to say how well they work; regardless of the extent to which MNCs comply with the letter and spirit of IRS rules, they will always have considerable latitude in using license agreements as vehicles for moving funds internationally.

Many host governments tax international transfers involving royalty payments. While this can dampen licensing activity, managements have alternatives here too. They may, for example, inflate the fees they charge their subsidiaries by the amount of the tax. In such cases, the host government is likely to know perfectly well what is going on. If it wishes the technology transfer to take place, the host country can set a tax, perhaps for political purposes, and accept the fact that fees will be inflated. If it wishes to stop the practice, the government can always set ceilings on maximum royalty rates. This narrows the MNC's room for maneuver; if the firm cannot find another financial conduit, it may decide to leave the market.

Appendixes

Appendix A

Glossary

ACH, automated clearinghouse: An electronic funds transfer system linking banks with one another, and often with non-financial institutions as well.

affiliate: As defined by the U.S. Government, 10 percent or more equity interest suffices to make one firm an affiliate of another (other countries may use different percentages). The U.S. Government does not distinguish between minority (10 to 50 percent) and majority ownership. (*See* FDI.)

AI, artificial intelligence: Computer systems with the ability to learn and improve in performance as a result of experience. More broadly, systems that mimic aspects of human reasoning are sometimes termed AI even if no learning is involved. (*See* expert system.)

AID, Agency for International Development: Principle U.S. Government organization for channeling economic aid to less developed countries.

back-to-back loans: Two parties in different countries make loans to one another, of equal value, each loan denominated in the currency of the lender and maturing on the same date.

banker's acceptance: A negotiable instrument drawn on and accepted (i.e., guaranteed) by a bank—e.g., for financing the export, import, shipment, or storage of goods.

Basel Committee: The Committee on Banking Regulations and Supervisory Practices, also known as the Cooke Committee, an advisory group of representatives of central banks and bank supervisory authorities from 11 countries. The Committee meets at the Bank for International Settlements in Basel, Switzerland.

BOCs, Bell Operating Companies: Local telephone companies grouped into regional holding companies (RHCs) since the AT&T divestiture.

CAD/CAM, computer-aided design/computer-aided manufacturing: CAD refers to computer automation of architectural and engineering design, primarily in the sense of geometry. CAM refers to automated manufacturing, with applications of numerically controlled machine tools the most common case.

CADD, computer-aided design and drafting: Automated processes for generating drawings (and auxiliary information such as parts lists), with the emphasis on automation of the drafting function rather than on engineering.

capital ratio: A bank's ratio of capital on hand to total liabilities. Regulatory authorities impose minimum capital ratios on banks.

CCITT: The Consultative Committee for International Telephone and Telegraph of the International Telecommunication Union (ITU).

CHIPS, Clearing House Interbank Payments System: A computerized network for arranging transfers of U.S. dollar payments among 140 depository institutions with offices in New York City.

CO (central office) switch: A large telephone exchange, today typically computerized.

commercial bank: Sometimes called full-service banks, the traditional basis for commercial banking has been the acceptance of short-term funds, mostly demand deposits, and the financing of term loans. (*See* investment bank and universal bank.)

commercial paper: A company's short-term unsecured promise to repay a fixed amount (equal to the borrowed funds plus interest). Some commercial paper is also backed by a third party (e.g., a bank that agrees to repay the loan if the original borrower defaults).

Comsat, Communications Satellite Corp.: A private company, U.S. signatory to and part owner of Intelsat (International Telecommunications Satellite Organization).

COS, Corporation for Open Systems: A nonprofit organization of American and some foreign computer and telecommunications firms, established to work toward technical standards for computer networks.

cross-licensing agreement: An arrangement whereby two firms agree to share technologies of specified types, including those as yet undeveloped.

currency swap: A financial transaction in which the parties exchange specified sums in two different currencies.

design-bid-build: Contracting arrangements in the engineering and construction industry in which separate contracts are let for design (which may include architectural design) and construction. Specifications developed in the design phase become the basis of a request for bidding on construction.

design-construct: Contracting arrangements covering an entire project; the contractor carries out the design and engineering work, construction, and may also handle installation of equipment (resulting in a turn-key project).

DP: Data processing.

E&C: Engineering and construction.

EC, European Community; EEC, European Economic Community: Belgium, Denmark, France, the Federal Republic of Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Spain, Portugal, and the United Kingdom. The EEC provides a common market; the EC comprises the EEC, the European Coal and Steel Community, and the European Atomic Energy Community.

EMP, Engineering Multiplier Program: Extends U.S. Export-Import Bank loans to foreign parties for the purchase of architectural and engineering services from U.S. firms.

Eurobond, Euronote: A bond or note sold in a market outside national regulatory frameworks for financial transactions; Euronotes are short-term bonds. Originally, the major offshore or external markets were located in Europe (specifically, London); now they also exist in other world financial centers. (*See* offshore market.)

Eurodollar: Dollar deposits, bond holdings, and other dollar-denominated financial instruments not subject to the normal regulatory control of the United States.

Euroyen: Yen deposits, bonds, and other yen-denominated financial instruments not subject to the normal regulatory control of Japan.

Eximbank: Export-Import Bank of the United States, a federally chartered institution with responsibilities centering on the financing of U.S. exports.

expert system: A computer system exhibiting a form of artificial intelligence (AI) in which the system's software embodies the knowledge of one or more human experts. The system can then act as a decision aid or automate a process that would otherwise require active participation by a human expert. In practice, expert systems have much more limited capabilities than the name might seem to imply, typically performing at rather rudimentary levels of competence.

FDI, foreign direct investment: Assets wholly or partially owned by foreign residents (individual or corporate), and including real estate or other property as well as equity holdings in corporations. Under U.S. Government definitions, ownership levels of 10 percent or more qualify as FDI, less than 10 percent as portfolio investment.

fiber-optics: Refers to systems using thin glass fibers to transmit communications signals via light (rather than electricity).

fourth-generation computer language: One in which the programmer specifies the desired outputs, but need not define the coding on a line-by-line basis.

FRA, forward rate agreement: To protect against future movements in interest rates, two parties agree on an interest rate for a future financial transaction. No commitment is made by either party to lend or borrow the principal amount of the transaction; exposure is limited to the interest difference between the agreed and actual rate at the time of settlement.

FRN, floating-rate note: A medium-term security carrying a variable or floating rate of interest, adjusted at regular intervals (typically every 3 or 6 months) with respect to a reference rate (commonly the London Inter-Bank Offered Rate).

futures: Contracts, traded on exchanges, generally calling for delivery of commodities or financial instruments at some future date.

GATT, General Agreement on Tariffs and Trade: An organization and set of rules under which 92 nations negotiate trade agreements and seek to resolve trade-related disputes.

Generalized System of Preferences: By international agreement, industrial nations—including the United States, Japan, and the members of the European Community—grant preferential tariff treatment to goods from specified developing countries.

Giro payment, Giro system: A system for financial payments based on standardized forms that authorize transfers of funds from the payer's account to the payee's, widely used in some European countries for transactions such as consumer billings.

Glass-Steagall Act, the Banking Act of 1933: Its best known provisions require a separation of commercial and investment banking activities.

IBF, International Banking Facility: Permits U.S. financial institutions to legally provide deposit and loan services from their domestic offices to foreign customers free of reserve requirements and other regulations that apply to their business with U.S. customers.

Intelsat, International Telecommunications Satellite Organization: Created in 1964 by international treaty, and jointly owned, Intelsat supplies nearly all cross-border satellite communications services.

interest rate swap: A transaction in which two parties exchange interest payment obligations of differing character. Examples include: coupon swaps—fixed rate to floating rate in the same currency; basis swaps—one floating rate index to another floating rate index in the same currency; and cross-currency interest rate swaps—fixed rate in one currency to floating rate in another.

investment bank: An intermediary between those seeking capital by issuing securities (government bodies as well as private firms) and those with money to invest. In recent years, investment banking has expanded rapidly into such related activities as leasing, mergers and acquisitions, and financial advisory services.

ISAC, Industry Sector Advisory Committee: Set up under the Trade Act of 1974 to convey the views of particular industry sectors on trade negotiations and related matters to the Office of the United States Trades Representative and the Department of Commerce.

ISDN, Integrated Services Digital Network: Telecommunications systems able to handle voice, data, facsimile, and video signals over common channels.

ISO, International Organization for Standardization: Membership includes some 75 countries, represented through their national standards bodies. Countries without a standards association participate as correspondent members.

IT services: Information technology services, including telecommunications, data processing, and computer software.

ITA: International Trade Administration, part of the U.S. Department of Commerce.

ITC, International Trade Commission: An independent government agency, the U.S. International Trade Commission has responsibilities that center on the investigation and disposition of complaints alleging violations of the Nation's trade laws.

ITU, International Telecommunication Union: Membership of about 160 countries; has the status of a treaty organization. (*See* CCITT and WATTC.)

JTPA, the Job Training Partnership Act: Enacted in 1982, Title III of JTPA offers services to displaced workers, including counseling, job search and placement assistance, and vocational training. The Federal Government provides JTPA funds to be administered at the State and local level.

junk bonds: High-yielding bonds, generally rated below Baa by Moody's or BBB by Standard & Poor's. Sometimes used in corporate takeovers or buy-outs.

LANs, local area networks: A computer network linking machines in a single building or similarly limited setting.

LDC: Less developed country.

letter of credit: Most commonly, a guarantee by a bank to make payment on behalf of its client, usually an importer.

MAP, Manufacturing Automation Protocol: A set of technical standards for linking computerized manufacturing equipment.

MITI: Japan's Ministry of International Trade and Industry.

mixed credits: Financing that mixes export credits in the form of loans with grants for development assistance, the latter usually taking the form of tied aid credits.

MNC: Multinational corporation.

MTN: Multilateral trade negotiation.

national treatment: Equal treatment by government of foreign-owned and domestic firms.

NIC, newly industrializing country: NICs have higher levels of national income than LDCs.

NTB, non-tariff barrier: Examples include import quotas and subsidies for domestic firms.

NTT, Nippon Telegraph & Telephone Corp.: Japan's largest telecommunications company, formerly a public corporation and monopoly supplier of services. Forty-nine percent of NTT's stock is now being sold to the public.

OECD, Organization for Economic Cooperation and Development: A group of 24 industrialized countries, including the United States, Japan, and the major European economies.

off-balance-sheet activities: That part of a bank's business, typically fee-based, that does not involve taking deposits and booking assets. Examples include arranging swaps and providing letters of credit.

offshore market, also external market and Euromarket: A market for bonds, deposits, credits, and other financial instruments not under the normal regulatory control of any country.

onshore market: That part of a financial services market in which foreign-owned firms participate alongside domestic firms (and under the regulatory and supervisory control of the national government).

OSI, Open Systems Interconnection: A reference model for computer network architectures.

proprietary technology: Unique knowledge and expertise under the control of a particular firm.

PTT: Post, telegraph, and telephone authority, in most countries, the monopoly provider of services.

repatriated earnings: Income from foreign investments that a firm returns to its headquarters location.

reserve requirements: U.S. commercial banks must keep a portion of their funds in a reserve account at a Federal Reserve Bank (or other designated institution). Other countries follow similar practices.

retail bank: Financial institution that supplies a wide range of services to individuals (as compared to a wholesale bank that specializes in services for, say, corporations).

RHC, regional holding company: One of the seven regional telephone companies formed with the breakup of AT&T, each consisting of several Bell Operating Companies (BOCs).

securitization: Refers to the development of markets for negotiable instruments, such as commercial paper and floating rate notes, as a means of borrowing (e.g., as an alternative to bank loans). Used more narrowly, securitization refers to the conversion of bank assets such as mortgages and other loans into negotiable securities for purchase by other financial institutions or by non-bank investors.

software: Computer program(s), the instructions that tell a computer (or any system embodying a digital processing unit) what to do.

standby letter of credit, SLC: An agreement by a bank to extend credit should other prospective lenders decline to do so.

Strategic Computing Program: Managed by the Defense Advanced Research Projects Agency of the U.S. Department of Defense, the program aims at developing AI-related technologies with applications to military systems. Examples include pilot's aids and automated land vehicles.

swap: *See* currency swap, interest rate swap.

SWIFT, Society of Worldwide Interbank Financial Telecommunications: An international network for communications among banks, jointly owned by the members.

TBDF: Transborder data flow.

TDP, Trade and Development Program: U.S. Government program that finances planning and feasibility studies undertaken by American firms in Third World countries offering U.S. export opportunities.

Teletel/Minitel: French videotex system operated by the government and making use of the telephone system to supply services, most of them originating with private firms, via small specialized terminals.

tertiary services: As used in this assessment, refers to a subset of traditional service industries (e.g., shipping, retailing) that depend less heavily on technology and know-how than knowledge-based services (including banking and information technology services, among others).

tied aid: Development assistance restricted (or tied), typically by requirements that goods and services be procured in the donor country. *See* mixed credits.

universal bank: A financial institution active in both commercial and investment banking (permitted in many parts of the world, but not in the United States).

U.S. International Trade Commission: *See* ITC.

US&FCS: United States and Foreign Commercial Service, trade promotion arm of the Department of Commerce.

VAN, value-added network: A computer/telecommunications network that provides enhanced services—i.e., services over and above the provision of a communications channel. The added value comes through provision of some further service, such as electronic funds transfers or access to a database.

videotex; videotext/teletext: Information services provided over communications networks that range from news reports and teleconferencing to on-line shopping. Typical videotext services combine text and graphics interactively, usually over the telephone network to a computer or a terminal. Teletext consists of one-way transmission of text. Collectively, videotext and teletext are called videotex.

WATTC, World Administrative Telephone and Telegraph Conference: Meetings of the International Telecommunication Union (ITU) called to consider changes in that body's regulations.

WIPO: World Intellectual Property Organization, administers the Berne Convention for the Protection of Literary and Artistic Works.

zero coupon bonds: Long-term securities calling for a single lump-sum payment at maturity, rather than periodic interest payments.

Appendix B

Analyzing Competitiveness in the Services

Given the usual assumptions of international trade theory, nations should be able to gain individually and collectively by specializing in goods that each can produce with greatest efficiency.[1] The United States produces and exports food and aircraft, among other things. South Korea produces and exports television sets and steel. Does the theory of comparative advantage, developed originally for goods depending on static resource endowments —wheat, cotton, cloth—apply to trade in services? The answer is yes. The theory, after all, simply provides a framework for explaining observed patterns of trade. So long as the framework remains an open one, capable of accommodating dynamic effects—shifting economies of scope and scale, learning, development of new technologies—trade in services fits just as well as trade in goods.

Indeed, trade in services exemplifies what is perhaps the principal feature of dynamic comparative advantage: efficiencies resulting from experience that accumulates over time. Agriculture, mining, and some kinds of manufacturing (steel if not computers) depend heavily on inherent, thus static, resource endowments. Services like banking or health care depend on know-how and expertise—technology, broadly defined—on human resources rather than natural resources. At least in theory, liberalization of trade in services should help increase global economic efficiency. Moreover, because of the dynamic learning effects, countries that currently have inefficient service industries should be able to improve quite rapidly by bringing in people and technology from more efficient foreign industries; competition will serve as a spur to domestic firms, while the foreign-owned firms will enlarge the pool of know-how that all can draw upon.

Influences on Competitiveness[2]

When OTA began studying the competitive standing of U.S. industries in 1978, no one had a very clear idea of how to do this. Economists tended to rely on output-side indicators—trade balances and market shares, employment and profit levels—in many respects little more than symptoms. The need was to get at causes, to grasp the dynamics of change in industries as varied as microelectronics and steel, and to sort long-run competitive trends from short-term events. This means understanding the internal workings of firms and industries: how business decisions are made; where investment capital comes from; how new products are developed.

As a result, OTA has stressed factors that affect competitiveness on the input side—i.e., as influences on the behavior of firms. In particular, OTA has attempted to understand competitive strategies in various parts of the world as affected by the many forces that condition management decisions (table B-1). Direct and indirect impacts of Federal policies —taxes, regulations, trade measures—have been central concerns, along with foreign industrial policies.

Note that all the factors listed in table B-1 are, to considerable extent, sector- and firm-specific. In any economy, sectors compete with one another to attract skilled labor, to push government regulations in directions that will benefit them relative to other industries. Within sectors, firms compete in much the same way. BankAmerica and Chase share some interests that differ from those of, say, insurance companies; in other cases, one bank may seek regulatory decisions that will help it against others. Thus, as the table suggests, OTA's approach begins with the internal workings of firms and industries.

The approach concentrates on forces with *differential impacts* across industrial sectors. While control of the money supply, for instance, influences economic conditions, the impacts, though not necessarily identical, remain much the same across the economy. In contrast, the corporate tax code treats economic sectors in quite different fashion. The Economic Recovery Tax Act of 1981, while decreasing average corporate tax liabilities, widened the spread in effective tax rates across sectors. The effects of the Tax Reform Act of 1986, which represents a more sweeping set of changes in U.S. policy, have not as yet become fully apparent (the appendix to chapter 10 illustrates a few of the probable impacts on service industries).

While analysis of individual service sectors demands a relatively detailed approach, analogous to that suggested in table B-1, the forces listed in the table can nonetheless be summarized under two main categories: those under the control of the firm, and those subject to public policy influence but largely beyond the control of individual companies (table 7, ch. 2).

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[1] For a discussion of comparative advantage and its relationship to competitiveness, see *International Competitiveness in Electronics* (Washington, DC: Office of Technology Assessment, November 1983), pp. 164-177.

[2] For an expanded version, with examples from manufacturing industries, see J.A. Alic, "Evaluating Industrial Competitiveness at the Office of Technology Assessment," *Technology In Society*, vol. 9, 1987, p. 1.

Table B-1.—Influences on Competitiveness in the Services

Factor/examples

1. ***Industry and market structure:*** Number of *firms*, their size and market power, financial resources; *market* size, rate of growth, degree of saturation.
2. ***Labor force:*** Labor *costs*; availability of skilled employees; government support for *training* and education; incentives for corporate training programs; labor *mobility*, vertically as well as geographically; labor-management relations; unionization; mechanisms for employee participation.
3. ***Managerial work force:*** Education and training; attitudes and value structures; characteristic approaches (e.g., in terms of risk taking) to *developing, marketing, and exporting services*.
4. ***Inputs:*** Stability of *costs and supplies* for inputs to the production process (data processing hardware and software, telecommunications links); domestic availability v. dependence on imports; delivery schedules.
5. ***Supporting infrastructure***: *Vendors, subcontractors*, and other suppliers, including those who provide services such as equipment maintenance; basic research organizations; government support for military and for generic, pre-competitive R&D as these may affect the services.
6. ***The environment for innovation and technology diffusion:*** Interactions and synergies among firms, within an industry and across national boundaries (mobility of personnel, licensing and other technical exchange agreements, openness to inward transfers of technology and management know-how); *clusters of knowledge and skills*, as in major banking centers; intellectual property law.
7. ***Business and economic conditions:*** Overall economic prosperity as indicated by gross national product or gross domestic product, levels of disposable income, inflation rates, costs of capital, exchange rates; less tangible factors such as consumer confidence, political stability, social welfare.
8. ***Government policies and interactions with the private sector:*** *Regulations* affecting the workplace and products, as well as resource supplies; *tax policies*; antitrust enforcement; less tangible factors including traditions of cooperation or conflict among government, business, labor, and other interest groups.
9. ***International trade relations:*** Policies enacted by domestic and foreign governments affecting *imports, exports, and foreign investment*; non-tariff barriers; taxes on overseas profits; the role of international agreements and organizations such as the GATT (General Agreement on Tariffs and Trade) in providing frameworks for policy and mechanisms for dispute resolution.

SOURCE: Office of Technology Assessment, 1987

Cost-Competitiveness in the Service Industries

Fundamentally, international competitiveness depends on the ability of companies in various parts of the world to develop, produce, and distribute services and goods in competition with one another. When the products are more or less the same (e.g., a bank loan), the comparison reduces to one of costs. Of course, companies differentiate their products, even when they are nominally quite similar (checking accounts, life insurance, air travel).

Trade and foreign investment result because costs for producing services differ across countries. These costs include:

- investments in physical capital (e.g., buildings, office equipment, airplanes);
- wages, salaries, and fringe benefits;
- human capital premiums, over and above other labor costs, paid to attract highly skilled employees;
- natural resource costs, often important for goods, but seldom for services; and
- costs for developing or acquiring proprietary technology (firm-specific know-how, patented or otherwise protected technology).

Costs associated with human capital and proprietary technology are closely related, because people develop and transfer technology; much of a firm's proprietary know-how resides in its more highly skilled employees. The remainder of this appendix outlines some of the factors that complicate cost comparisons internationally, beginning with exchange rate fluctuations.

Exchange Rates

For qualitatively similar products, actual selling price becomes the critical factor in commercial competition. Everything else the same, a free checking account will attract more customers than one with a monthly service charge. For internationally traded services, it is landed, tax-paid prices in the country of sale that matter. Prices for imports must cover transport costs, if these exist. In addition, the price of an imported service will reflect the rate of currency exchange between the country where the service was produced (wholly or partially) and the country of sale.

When the U.S. office of an American engineering and construction (E&C) firm prepares a bid on the design of an airport—say in Egypt—it will typically compile its cost estimates in dollars. The company may plan to carry out some or all of the design work in the United States. The people working in its U.S. offices must be paid in dollars. So must the expenses for the equipment they use, the buildings they work in, and other overhead costs. Similarly, an E&C firm in Japan bidding on the same project would denominate its costs in yen. If the American company entered a bid for the design work priced at $10 million, the Japanese firm bid 2000 million yen, and the rate of exchange were $1 = 200 yen, the bids would be equivalent. If the exchange rate later dropped to $1 = 150 yen, the American firm would have an advantage of 33 percent; the Japanese company's bid of 2000 million yen would then convert to $13.3 million. Likewise, if the dollar rose to $1 = 250 yen, the American firm would find itself at a disadvantage.

Note that these comparisons assume the actual costs to the E&C firms in the two currencies to be independent of the rate of exchange—an assumption that is usually valid over the short term. With time, as prices and wage levels in a national economy change, exchange rates normally adjust in sympathy. If prices rise in the United States, the value of the dollar should drop compared to other currencies (so that prices would remain about the same when denominated in these currencies). But the point of the example is a simpler one: to compare costs or prices internationally, they must be expressed in the same currency. One or more conversions will be required; the bids could be compared in dollars, in yen, or in Egyptian pounds.

Determination of Comparative-Cost Advantage

For a given rate of exchange, then, prices can be compared, and relative costs inferred. These costs, particularly their indirect components, will depend on factors including human capital requirements and technology (table B-1). Not all countries can produce all services; some lack the necessary skills (or other inputs). It is impractical if not impossible to perform heart transplant operations in Ecuador, or to conduct much international banking from a base in Nigeria. A wealthy resident of Ecuador would travel to another country for such an operation; Nigerian firms procure international financial services from branches of foreign banks in Lagos or through the correspondent relationships of Nigerian banks.

Trade barriers, in one way or another, raise costs for imports compared with domestic goods and services: this is their purpose. A tariff is the simplest example—as a tax levied only on imports, it raises the costs of products entering the country compared to domestic output. Barriers to services trade tend to be indirect, with impacts less obvious than for direct barriers like tariffs (chs. 2 and 9). Nonetheless, to be effective, indirect or non-tariff barriers must have impacts on relative prices. Thus subsidies for domestic firms permit them to lower prices, while quotas drive up prices for imports.

Relative costs say nothing about the *volume* of trade. But because costs generally drop with output, trade volumes themselves will affect cost comparisons. While a rank ordering by industry of a nation's structure of comparative advantage cannot yield predictions of trade flows, such a listing does give insights into the gains to be expected from trade: for instance, transactions involving goods or services at the far ends of a nation's ranking lead to much greater benefits than for goods or services near the middle. In the extreme, potential gains from non-competitive imports (where no domestic production exists) can be very large. Technical licensing, for example, can be a great help for an importing nation unable to develop comparable technologies on its own.

Transportation Costs

Modes of transport for the services are not so obvious as for goods. Sometimes consumers move to the source of the service; sometimes producers must be transported to the point of consumption. Leased equipment may have to be shipped overseas, then returned (though the leasor may choose to sell it locally after expiration of the lease, rather than shipping it back).

When service products consist of information that can be transported or transmitted in the form of images, text, or data, the transmittal costs are sometimes (though not always) small compared to the value of the information. New communications and information processing technologies have helped break down the constraints that in an earlier era required services to be produced close to the customer or end-user. But much more may be involved than simply transmitting information. Licensing transactions typically entail substantial expenses for transferring knowledge, as well as for the protection of know-how (ch. 6). Negotiating tightly written contracts for safeguarding proprietary knowledge can be viewed as part of the process of packaging technology before sending it overseas. Licensors may send technical specialists to the importing country to help train the licensee's work force, or aid in startup operations—one of many examples where cheap air transportation has helped firms move people to markets in order to supply service products across national boundaries.

At an opposite extreme, when transportation costs would be large compared to the value of the product, the service becomes effectively non-transportable, and can be viewed as non-tradeable. Many tertiary and personal services (table 6, ch. 1) fall in this category; not many people cross national borders to get their hair cut. Where either the consumers or the producers of services do travel, it is usually for high-value-added services: tourism; medical care; education; business services such as accounting. For tourism particularly, a nation's exports normally rise if travel costs—e.g., air fares—drop.

Flexibility in Pricing and Production

An empty hotel room, a vacant airline seat—both represent irretrievably lost production. While a factory that is shut down this week may be able to run double shifts next week, little or no flexibility exists in capacity utilization for service businesses like hotels or restaurants; capacity that goes unused means revenues that can never be regained. In such industries, profits depend critically on occupancy rates and load factors; an airline may lose money if its planes operate at an average load factor of 60 percent, make a healthy profit if it can fill 70 percent of its seats.

At the same time, many costs of production in the services tend to be fixed, leading to a good deal of flexibility in pricing. Because manufacturing firms purchase not only labor, but raw materials, energy, and, in many cases, substantial volumes of components and subassemblies, they will generally have a higher ratio of variable to fixed costs (e.g., plant and equipment) than service firms. The major U.S. automobile manufacturers buy parts and components from thousands of suppliers. Service firms, in contrast, may buy or lease equipment such as computers, but otherwise purchase little in the way of goods and services—certainly compared with manufacturing firms having comparable payrolls. (Construction is perhaps the major exception; projects of any size normally involve many subcontractors. Of course, a bridge or a building fits few of the usual criteria for a service product.[3]) An automaker can shut down for a week to adjust its inventory levels, while an airplane flies with a full cockpit even if half-empty. Moreover, the airplane will burn about as much fuel carrying 100 passengers as 200. And, while much manufacturing labor can be treated as a variable cost—because people can be put on short hours or laid off if demand drops—the salaried professionals in, say, a computer software or legal services firm normally get paid even when business is bad. Thus, more of the bill for wages and salaries in a service firm may effectively be fixed.

When fixed costs are high compared to variable costs, the firm has more room for maneuver in pricing decisions. A company must pay its variable costs as they are incurred; an added unit of output means added costs. No matter the short-run competitive pressures, it cannot cut prices below variable costs without losing money. But fixed costs, by definition, neither rise with added output nor fall when output is cut back. A computer software firm with mostly fixed costs can cut prices deeply while still covering variable costs.

This relative freedom in pricing opens a range of marketing strategies seldom available in manufacturing. Airlines not only offer cheaper fares for advance purchases to help keep their planes full, they charge different fares at different times of the day and different times of the year. When they slash fares for travel on Thanksgiving and Christmas, the rationale is simple. The planes will be flying anyway. In the past, fewer than half of all airline seats had been filled on these 2 days. Any revenue gained by selling more tickets helps pay for the fuel, flight crews, and other expenses that will be incurred in any case. Different fares depending on the day of the week illustrate the same point: market conditions determine fares more than costs. In the winter, air fares may be lower to Chicago on the weekend, but higher to Miami, because business travelers (who fly mostly during the week) go to one city and vacationers to the other; the airlines are simply trying to fill empty seats.[4]

Service firms where production is in the hands of skilled or professional employees also gain extra latitude in pricing because they can ask people to work overtime without paying them more. In industries like banking or law, salaries may be high but the added costs of extra output are small—and the added profit may be large. (At some point, of course, the bank will have to hire more loan officers or the law firm add more attorneys.) Furthermore, the greater the reliance on salaried employees, the greater the firm's discretion in allocating costs and setting prices. Labor costs on a factory assembly line can more easily be traced to output than in the loan department of a bank. While the differences may be matters of degree, if costs cannot be allocated directly to each unit of output, then the notion of cost-based comparative advantage becomes less useful. Likewise, discretion in allocating fixed costs suggests that dumping—selling abroad at less than domestic prices or costs—will be more difficult to prove for service firms than for manufacturing firms, a difficulty compounded when service outputs are non-standard and differ qualitatively.

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[3] If designing a bridge or a hospital seems more unambiguously a service than carrying out the construction, the plans, drawings, and bills of materials are nonetheless quite tangible; they can be stored, transmitted from place to place, and modified during the course of construction. The package of information constituting the design—or a computer program or an advertising campaign—has a permanent physical existence, unlike many of the services provided by a trial lawyer or a banker.

[4] A staff of 90 people handle American Airlines' future fare structure—at any one time, a matter of more than half a million future flights (1,600 per day, for 330 days ahead)—E. Schmitt, "The Art of Devising Air Fares," *New York Times*, Mar. 4, 1987, p. D1.

Of course, any firm must, over time, cover its total costs, not just its variable costs, else risk bankruptcy. The point is simply that, all things considered, service firms tend to have more freedom than manufacturing firms in setting prices. They can cut prices when entering foreign markets, or to keep imports out of their home market.

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